

UPDATE TO THE STATUS REVIEW  
OF Howellia aquatilis  
FIELD SURVEYS, MONITORING STUDIES,  
AND TRANSPLANT EXPERIMENTS  
1990

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## SUMMARY

Howellia aquatilis Gray (Campanulaceae) is currently included on the sensitive (Montana) and watch (Idaho) species lists in Region 1 of the U.S. Forest Service (U.S. Department of Agriculture 1988; Reel et al. 1989), and the sensitive list in Region 5 (Shelly and Moseley 1988). It was recently recognized (1990) as a Category 1 (candidate) species by the U.S. Fish and Wildlife Service, and is being considered for listing under the Federal Endangered Species Act of 1973. Survey work for this species has been ongoing in Montana since 1987, resulting in a total of 59 occurrences, clustered into 9 pond groups. Two of the 59 populations were located in 1990. Thirty-eight populations (50% of those known globally) occur wholly or partially on Flathead National Forest lands. Also, six ponds were surveyed which did not contain H. aquatilis, bringing the total number of ponds surveyed in Montana to 428. Results of population size estimates (1987, 1989, 1990) and data obtained from transects utilizing line-intercept (1987, 1989, 1990) and frequency measures (1989, 1990) show that the population sizes of this annual species fluctuate from year to year. Population size fluctuations correlate well to climate factors of precipitation and temperature; these factors affect the drying time of ponds in fall when germination occurs. Seeds of H. aquatilis do not germinate under water, thus it is hypothesized that in years when precipitation is above normal and temperatures are below normal (such as in 1988 and in 1989), ponds do not dry out or dry out late in the year. The result may be a reduction in population size the following year (as was observed in 1989 and 1990). The transplant experiments were partially successful. A small number of plants were established in two of the transplant ponds in 1990 (Pond A: 32 plants, and Pond B: 5 plants). Both ponds contained plants that were reproductive. Two other ponds (C and D) contained no plants; these ponds had water in them when the transplants were done in September, and probably did not dry out much more prior to freezing. This appears to confirm the fact that H. aquatilis seeds do not germinate under water. While the transplants to ponds A and B could be considered a success in 1990, it remains to be seen whether or not these small H. aquatilis populations are present next year or thereafter. Recommendations are made for continuing studies.

## I. INTRODUCTION

This report summarizes the results of monitoring studies and field surveys conducted from 1987-1990, to assess the status of Howellia aquatilis Gray (Campanulaceae). This species is designated as a sensitive plant by Region 1 of the U.S. Forest Service, and occurs on the Flathead National Forest. Previous reports summarize the status of research conducted prior to the 1990 field season (Shelly 1988, 1989; Shelly and Schassberger 1990).

The field work conducted in 1990 represents the second year of a three-year inventory and analysis project. The purpose of this project is to assemble adequate information on the distribution and status of the species, in order to prepare a U. S. Forest Service species management guide. The 1990 goals were:

- 1.) continue field surveys of potential habitat for H. aquatilis on the Flathead National Forest and adjacent lands.
- 2.) resurvey 26 populations, emphasizing those found on Flathead National Forest lands, to obtain ongoing estimates of population size, condition, persistence, and response to management practices.
- 3.) monitor transplant experiments (soil plugs from ponds with high densities of H. aquatilis were placed in unoccupied potential habitats at four locations in September of 1989); read transects to determine success of transplants.
- 5.) continue quantitative monitoring studies established at five locations in 1988; includes line intercept and frequency measurements.

Field studies were conducted by the authors (Montana Natural Heritage Program/U.S. Forest Service). Surveys and monitoring studies were conducted 10-13 and 16-19 July 1990.

## II. REVIEW OF PRESENT STATUS

Howellia aquatilis is currently included on the sensitive (Montana) and watch (Idaho) species lists in Region 1 of the U.S. Forest Service (U.S. Department of Agriculture 1988; Reel et al. 1989), and the sensitive list in Region 5 (Shelly and Moseley 1988). It was recently recognized as a Category 1 (candidate) species by the U.S. Fish and Wildlife Service, and is being considered for listing under the Federal Endangered Species Act of 1973. A Category 1 species is one for which there is substantial biological information on file to support the appropriateness of proposing to list the species as endangered or threatened (U.S. Department of Interior 1990). It was

recommended by Shelly and Moseley (1988) that this species be moved from Category 2 to Category 1 for several reasons: (1) the species has been extirpated from a large portion of its previously known global range, (2) it has a narrow ecological amplitude, (3) it lacks detectable inter- and intrapopulation genetic variation, and (4) habitat alteration continues in a major portion of its extant range.

### III. UPDATE OF GEOGRAPHIC DISTRIBUTION

Upon conclusion of the 1990 field season, H. aquatilis was documented from a total of 76 extant populations worldwide: 1 in Idaho, 59 in Montana, and 16 in Washington. All known Montana populations are located in the Swan River drainage (Lake and Missoula counties). Within this drainage, a total of 428 wetlands have been surveyed; H. aquatilis has been found in 59 (13.8%) of them. The Montana populations constitute 77.6% of those known globally for the species. Thirty-eight populations (50% of those known globally) occur wholly or partially on Flathead National Forest lands. The land ownership status of the Montana populations is summarized in Table 1, p. 3.

Two new populations were discovered in previously unsurveyed ponds (occurrence numbers 058 (Salmon Prairie), and 059 (Lost Creek-Cilly Creek Ponds)). Six other previously unsurveyed ponds were also examined, but did not contain H. aquatilis. Element occurrence print-outs and location maps for the two new populations are included in Section VII, pp. 21-25. The locations of the ponds that were surveyed, but do not support H. aquatilis, are indicated on maps in Section IX, pp. 53-55.

Although H. aquatilis has not been found to occur outside of the Swan Valley in Montana, on the recommendation of Maria Mantas (Flathead National Forest), ponds which look suitable in the Lake Five area near West Glacier, Montana, should be surveyed in 1991.

### IV. MONITORING STUDIES

Details regarding population size and condition for the two newly discovered occurrences are summarized in Table 2, p. 4.

During 1990, 26 previously documented populations were re-surveyed, and estimates of population size and percent of each pond occupied by H. aquatilis were made. Updated occurrence records for these ponds are provided in Section VIII., pp. 26-52. Quantitative monitoring studies of five populations (008, 009, 013, 020, and 027) were continued. The locations of the resurveyed ponds and the long-term monitoring ponds are in an earlier status review (Shelly 1988). The methods for the quantitative monitoring studies are described in a report by Shelly (1989).

**Table 1.** Summary of land ownership for Montana populations of Howellia aquatilis (1990).

County	Site name	Number of populations on Flathead N.F. lands	Number of populations on Flathead N.F. <u>and</u> private lands	Number of populations on private lands
Lake	Lost Creek- Cilly Creek	12	0	0
Lake	Dog Creek	2	0	0
Lake	Swan River West	1	0	0
Lake	Salmon Prairie	0	1	1
Lake	Swan River Oxbow	0	1	0
Missoula	Condon Creek	9	0	4
Missoula	Elk Creek	1	1	0
Missoula	Kraft Creek	0	0	1
Missoula	Lindbergh Lake	9	1	15
<b>TOTAL</b>		<b>34</b>	<b>4</b>	<b>21</b>

**Table 2.** Population size and condition for Howellia aquatilis occurrences newly documented in 1989.

Occurrence number: 058

Site name: SALMON PRAIRIE

Acreage: 1

Population size and condition: 11-50 PLANTS COUNTED IN 1990; POND CURRENTLY SURROUNDED BY DENSE, UNDISTURBED TIMBER STANDS.

Occurrence number: 059

Site name: LOST CREEK-CILLY CREEK PONDS

Acreage: 1

Population size and condition: CA. 150 PLANTS COUNTED; ALL INDIVIDUALS OCCUR NEAR MIDDLE OF POND NEXT TO LOG; SHALLOW POND ( <2 FT. DEEP IN MOST PLACES) WITH FEW OPEN AREAS FOR PLANTS TO BECOME ESTABLISHED; SURROUNDING FOREST CURRENTLY INTACT.



**RESULTS:** The results of the population size surveys are presented in Table 3, p. 7. As stated in a previous report (Shelly and Schassberger 1990), these figures are to be strictly regarded as estimates. Nonetheless, they do indicate that populations remained fairly stable in size from 1987 to 1989; however, between 1989 and 1990, 20 populations were reduced in size by at least 50 percent, and 14 were reduced by more than 75 percent of the previous years' estimates. Anomalies over the period from 1987-1990 include the reduction in population size of H. aquatilis in occurrence 012 between 1987 and 1989 (while most other ponds remained the same or showed an increase in population size), and a slight increase in size of this same population in 1990 (while nearly all other ponds showed a reduction in population size). Population (026) showed an increase in population size between 1987 and 1989 (similar to most populations), but the population size again increased between 1989 and 1990 (contrary to all but population 012).

Also included in Table 3 are 1990 estimates of the percentage of each pond that is occupied by H. aquatilis. These estimates correlate well with the population size estimates (smaller populations generally occupy the smallest percentage of suitable habitat).

The results from the line-transect studies for three years are presented in Table 4, pp. 8-9. The four ponds for which water depth measurements were taken in both 1988 and 1989 were all deeper during the second year, with pond numbers 020 and 027 significantly deeper in 1989. In 1990, pond number 008 was only slightly less deep than in 1989, pond 013 remained the same (013), while the rest were slightly more deep.

As reflected in the population size estimates for the five ponds, line-transect data indicate that the percent cover of H. aquatilis was significantly lower in 1990 than in 1988 or 1989. Large population fluctuations reflect this species' annual habit, and the apparent influence of fluctuating water levels on yearly abundance.

Frequency measures for the five line-transect ponds indicated a less extreme drop in estimated population sizes between 1989 and 1990 than either the population estimate or line-transect methods. Results are presented in Table 4, p. 8.

**DISCUSSION:** Populations were observed to be greatly reduced in 1990, as shown by the results of line-transect, frequency and population size estimate studies. As stated in Lesica (1990), the possible reasons for fluctuating sizes of H. aquatilis populations include date of pond drying each year. The observed decline in population size in nearly all the surveyed ponds in 1990 may reflect a suboptimal drying regime in 1989. Climate data, including precipitation and temperature data from

January 1986-September 1990, for stations at Bigfork (Figure 1 and 2), and Seeley Lake (Figure 3 and 4), Montana, are provided on pp. 10-11 and 12-13, respectively (U.S. Department of Commerce 1982). Data indicate that total precipitation at Bigfork and Seeley Lake was below normal in 1988, but above normal in 1989 (Figure 1 and 3, pp. 10 and 12, respectively). The average yearly temperature was also below normal for both stations in 1989 (Figure 2 and 4, pp. 11 and 13, respectively), although not from January through August of 1990. More specifically, for August and September of 1989 (when germination might begin) temperatures were below normal for both stations. Finally, for the five monitoring ponds from 1988 to 1989 (Table 4, p. 8) pond depths were 10, 30, 40, and 55 percent deeper (ponds 008, 009, 013, 020, and 027 respectively) in 1989. In 1990, monitoring ponds were slightly deeper. Although this latter measurement is approximate (depth was measured with a meter stick each time and the stick may have been pushed deeper into the pond substrate from one year to the next), it still reflects a significant increase in water depth between 1988 and 1989. In combination, these factors could have resulted in less than optimal germination conditions for H. aquatilis in the fall of 1989, the outcome of which was the observed decrease in population size in 1990. Every pond is probably different with respect to drying regime, and therefore trend in population size. This may explain the anomalous results reported for ponds 12 and 26 over the past three years. If seed germination is enhanced when ponds are dry, then for most of the ponds, suboptimal drying regimes were present between 1989 and 1990.

Climate data are currently only available through September of 1990; however, for both the Bigfork and Seeley Lake stations, precipitation appears to have been below normal and temperatures above normal. Low H. aquatilis population counts might persist through 1991, since the latter half of 1990 was mostly above normal with respect to precipitation (Figure 1 and 3), and the depth measurements were similar to 1989 levels. However, if a warmer and dryer trend occurs through summer of 1991, population counts in 1992 would be predicted to be higher for most ponds.

Also of interest in the 1990 surveys was the number of ponds that were deep yellow-red in color, and had what appeared to be an oily slick on the surface of the water. It is postulated that if water levels remained high through the fall, more leaf material would remain in the water which would not decompose, but would instead leach into the water. The oil slick may also be an end product of leaching. In any case, a reduction in incoming light due to discoloration might also limit survival of H. aquatilis seedlings, resulting in smaller populations as observed in 1990. Heavy algal growth present may be the result of higher water temperatures. Algal growth could also limit establishment of H. aquatilis seedlings.

**Table 3.** Population size estimates (number of individuals), and percentage of pond occupied, for 26 Howellia aquatilis occurrences, Swan River Valley, Montana (1987, 1989, 1990).

OCCURRENCE NUMBER	1987	1989	EST. % OF POND OCCUPIED (1989)	1990	EST. % OF POND OCCUPIED (1990)
001*	75-100+	300-400	60	27	<5
006	1000-2000	1000-2000	50	500-1000	20
007	3000-4000	1000-2000	95	500-600	30
008	2000-3000	1000-1500	50	40+	10
009*	500-600	500-1000	30	220+	20
012*	400-500	16	<5	35	<5
013*	1000-1500	500-1000	50	33	5
014*	300-400	500+	50	150-250	30
016	400+	1000-1500	85	300-500	30 (clumped)
017	10-12	10-20	<5	0	(# <sup>1</sup> )
020	1000	1000-1500	60	190+	20
022	200	500-1000	70	60-100	25
023	3	400-500	55	20	<5
025*	25	100-125	<5	0	(# <sup>2</sup> )
026	200-300	500-1000	70	1000-2000	70
027*	300	300-400	40	200+	30
029*	200-300	500-1000	30	100-200	10
030*	1000	1000	55	0	(# <sup>3</sup> )
032	101-1000 (1983)	750-1000	40	3-10	5
035	51-1000 (1983)	500-750	40	0	(# <sup>4</sup> )
044	275-400	90-120	60	0	(# <sup>4</sup> )
045	300	300-400	20	10	<5 (# <sup>5</sup> )
046*	50	30-50	<5	3	<5
047*	200	200-300	20	150	15
048*	250	200	10	0	(# <sup>6</sup> )
049	1500-2000	2000+	65	200-300	15 (# <sup>7</sup> )

\* - Ponds whose margins or immediate surroundings have been physically impacted by timber harvesting.

Observations at selected sites (1990).

- #<sup>1</sup> - High cover of Carex vesicaria.
- #<sup>2</sup> - High cover of Nuphar variegatum and Carex vesicaria.
- #<sup>3</sup> - No apparent cause for lack of plants.
- #<sup>4</sup> - Oily scum on surface, water deep reddish-yellow to brown, possible dumping from road or decaying leaves.
- #<sup>5</sup> - Heavy algal bloom.
- #<sup>6</sup> - Dead sedges and cat-tails, water level appears high.
- #<sup>7</sup> - High cover of Lemna minor.

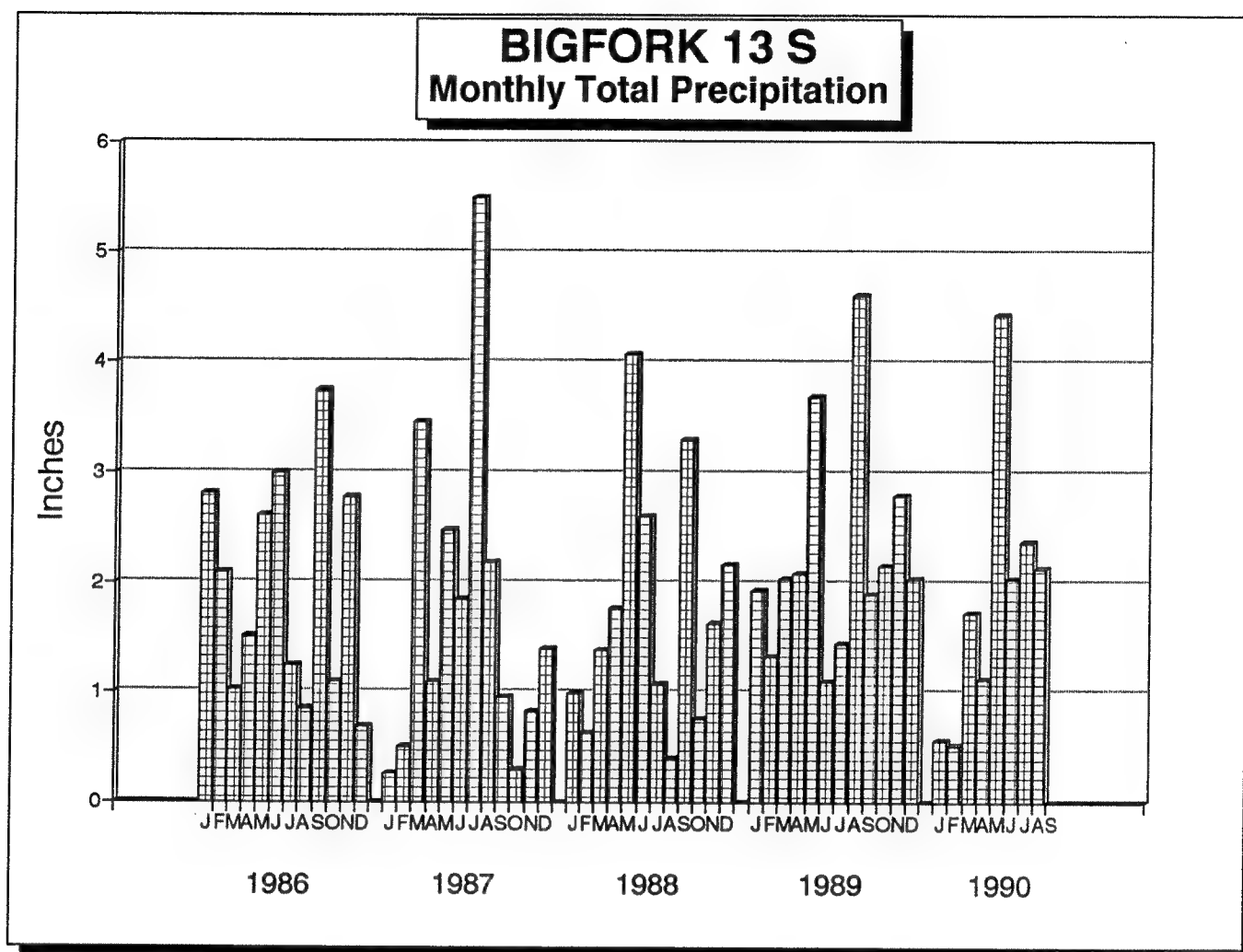
Table 4. Monitoring transect data, Howellia aquatilis and major associated species, Swan Valley, Montana, 1988-90. Cover data expressed as percentage of transect length occupied by the "canopy" of each species, as measured along line-intercept transects.

	<u>Occurrence number</u>				
	<u>008</u>	<u>009</u>	<u>013</u>	<u>020</u>	<u>027</u>
Date read 1988:	21 JUL	21 JUL	21 JUL	22 JUL	22 JUL
1989:	12 JUL	12 JUL	11 JUL	14 JUL	13 JUL
1990:	18 JUL	19 JUL	19 JUL	18 JUL	17 JUL
Transect length (m)	48.95	50.0	46.0	42.9	50.0
Water depth (dm)					
Tape point (m):	20.0 40.0	20.0 40.0	15.0 30.0	10.0 23.0	15.0 30.0
1988	not measured	3.1 3.2	1.7 1.8	2.72 2.64	1.96 1.50
1989	3.4 4.95	3.45 3.55	2.4 2.2	4.45 4.35	4.5 4.0
1990	3.1 4.06	3.6 3.81	2.4 2.1	4.8 4.75	4.7 4.5
Estimated % cover:	1988 1989 1990				
<u>Howellia aquatilis</u>	8.21 27.40 2.01	7.06 7.24 2.95	6.44 4.87 0.83	26.29 59.21 6.13	1.80 5.86 3.28
% frequency 1989:	56	36	69	95	40
1990:	25	18	16	19	8
<u>Alopecurus</u>	-	-	-	-	-
<u>aequalis</u>	- 2.85	- -	- -	- 8.74 -	- - -
<u>Carex atherodes</u>	- - -	- - -	- - -	- - -	9.40 34.0 1.90
<u>Carex rostrata</u>	19.10 32.93 24.25	- - -	19.37 20.37 26.27	9.88 9.98 15.52	14.96 14.2 32.0
<u>Carex vesicaria</u>	6.41 6.50 7.66	1.94 2.00 8.50	55.72 52.74 57.80	10.96 16.81 12.80	1.66 22.64 4.20

Table 4 (Cont.)

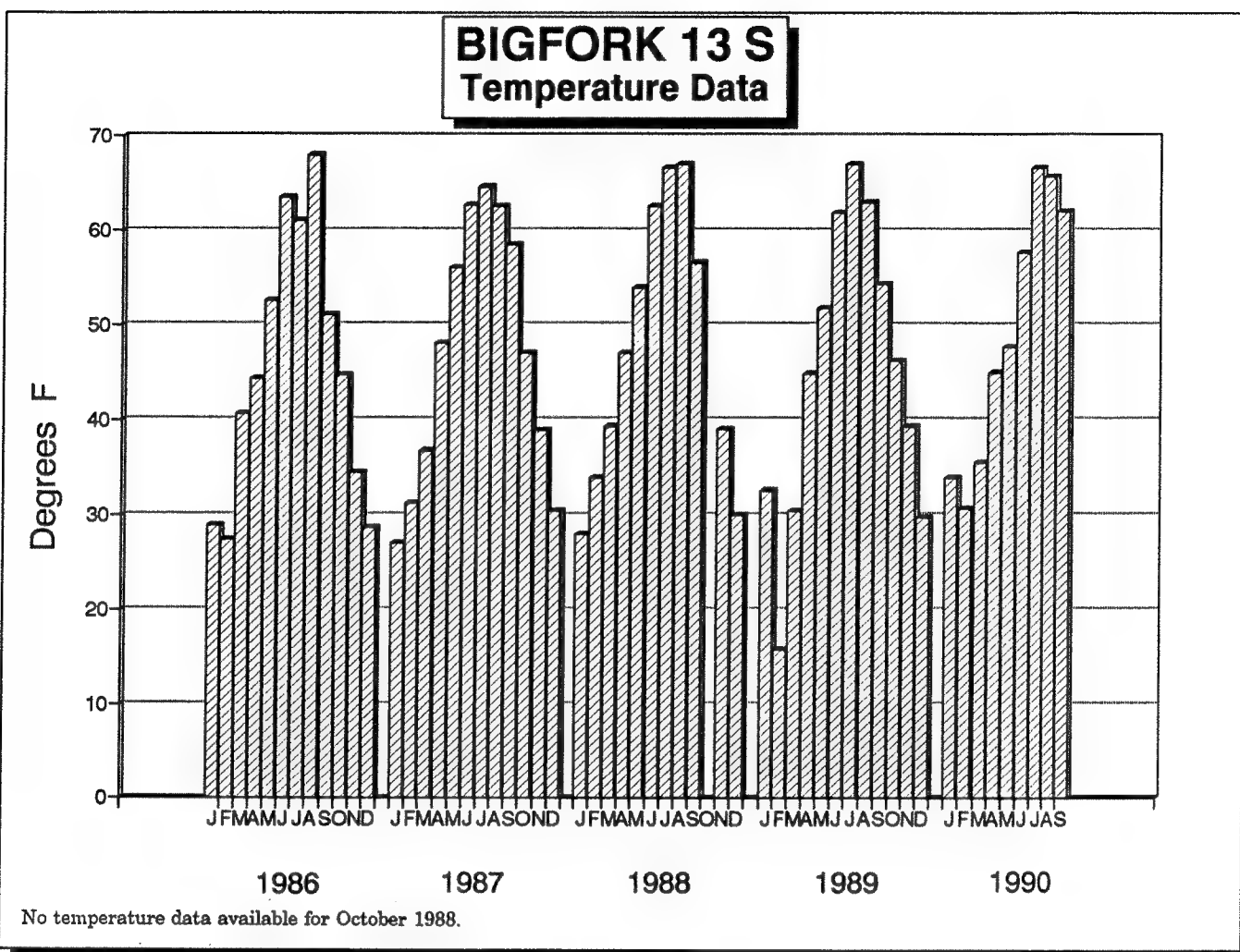
Estimated % cover	1988 1989 1990	Occurrence Number				
		<u>008</u>	<u>009</u>	<u>013</u>	<u>020</u>	<u>027</u>
<u>Eleocharis</u>	*	-	-	21.02	-	11.70
<u>palustris</u>	50.05	-	-	15.85	-	12.88
	46.86	-	-	27.54	-	10.65
<u>Equisetum</u>	-	98.26	-	-	-	-
<u>fluviale</u>	-	100.0	-	-	-	-
	-	99.20	-	-	-	-
<u>Glyceria borealis</u>	-	-	-	-	5.43	22.72
	0.51	-	-	-	1.42	16.72
	0.53	-	-	-	-	26.71
<u>Glyceria</u>	-	-	-	-	-	-
<u>grandis</u>	-	-	-	-	7.69	-
	-	-	-	-	-	-
<u>Phalaris</u>	3.47	-	-	-	-	24.76
<u>arundinacea</u>	2.55	-	-	-	-	25.74
	0.58	-	-	-	-	26.71
<u>Potamogeton</u>	-	0.50	-	0.71	-	-
<u>gramineus</u> (1990)	-	-	-	-	-	-
<u>Ranunculus</u>	-	-	-	-	-	-
<u>aquatilis</u>	-	-	-	35.62	-	-
	-	-	-	19.14	-	-
<u>Sium suave</u>	53.81	6.18	3.78	6.83	1.95	
	62.0	16.78	6.26	15.34	19.16	
	61.49	11.25	5.75	46.74	32.97	
Other Plants (1990)	3.49	-	2.38	16.71	-	
Fallen logs	2.12	4.02	4.70	1.82	1.50	
	2.02	9.04	3.17	4.03	4.46	
	2.11	12.20	3.82	3.19	1.98	
Open water 1989	8.11	-	6.87	2.87	2.28	
1990	2.91	-	1.88	12.00	2.00	
Open soil 1989	-	-	0.98	-	-	
1990	-	-	-	0.83	-	

\* - Eleocharis palustris was scattered throughout the pond (1988).

**FIGURE 1****BIGFORK 13S PRECIPITATION DATA \*\***

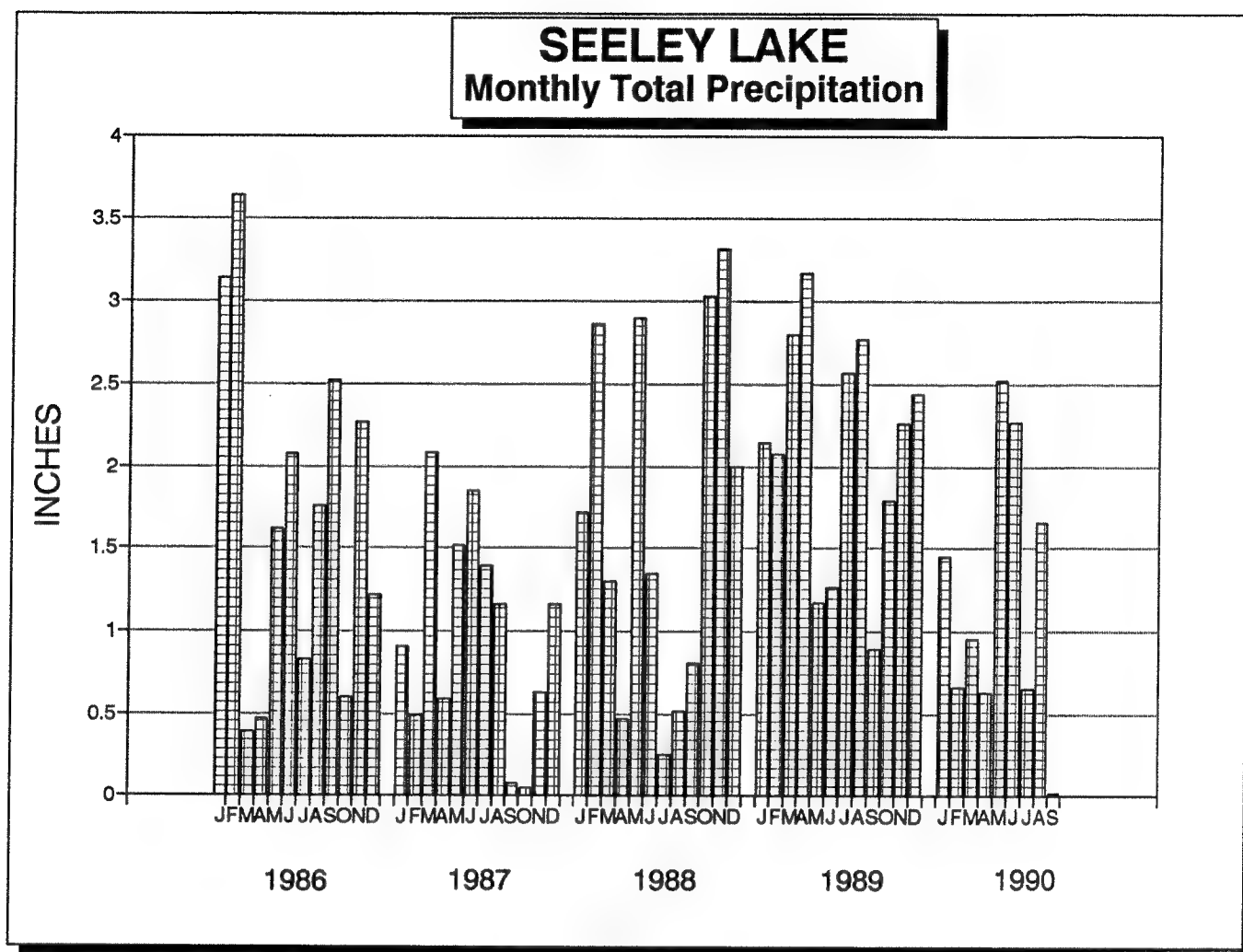
<u>YEAR</u>	<u>JAN</u>	<u>FEB</u>	<u>MAR</u>	<u>APR</u>	<u>MAY</u>	<u>JUN</u>	<u>JUL</u>	<u>AUG</u>	<u>SEP</u>	<u>OCT</u>	<u>NOV</u>	<u>DEC</u>	<u>TOT</u>
1986	2.81 (0.61)	2.09 (0.72)	1.03 (0.21)	1.51 (0.05)	2.61 (0.23)	3.00 (0.02)	1.24 (0.08)	0.85 (0.98)	3.75 (1.98)	1.10 (0.5)	2.77 (0.99)	0.69 (1.46)	23.45 1.37
1987	0.26 (1.97)	0.50 (0.87)	3.46 (2.22)	1.10 (0.36)	2.47 (0.09)	1.85 (1.13)	5.50 (4.18)	2.18 --	0.96 (0.81)	0.30 (1.30)	0.83 (0.95)	1.40 (0.75)	20.81 --
1988	0.99 (1.21)	0.63 (0.74)	1.38 (0.14)	1.77 (0.31)	4.07 (1.69)	2.60 (0.38)	1.07 (0.25)	0.40 (1.43)	3.29 (1.52)	0.76 (0.84)	1.63 (0.15)	2.16 (0.01)	20.75 (1.33)
1989	1.93 (0.27)	1.33 (0.04)	2.03 (0.79)	2.08 (0.62)	3.69 (1.31)	1.09 (1.89)	1.44 (0.12)	4.60 (2.77)	1.89 (0.12)	2.15 (0.55)	2.78 (1.00)	2.03 (0.12)	27.04 4.96
1990	0.56 (1.64)	0.51 --	1.72 --	1.12 (3.4)	4.43 (2.05)	2.03 (0.95)	2.37 (1.05)	2.13 (0.30)	0.00 (1.77)	--	--	--	--

\*\* FIRST LINE CONTAINS TOTALS, SECOND LINE CONTAINS DEPARTURES FROM NORMAL (1951-1980)  
 -- INDICATES MISSING DATA FOR THAT MONTH  
 NUMBERS IN PARENTHESES () ARE NEGATIVE VALUES

**FIGURE 2****BIGFORK 13S TEMPERATURE DATA \*\***

<u>YEAR</u>	<u>JAN</u>	<u>FEB</u>	<u>MAR</u>	<u>APR</u>	<u>MAY</u>	<u>JUN</u>	<u>JUL</u>	<u>AUG</u>	<u>SEP</u>	<u>OCT</u>	<u>NOV</u>	<u>DEC</u>	<u>TOT</u>
1986	28.8 3.0	27.3 (3.7)	40.6 5.3	44.2 0.1	52.5 0.2	63.5 4.2	61.0 (5.5)	67.9 3.0	51.0 (4.7)	44.7 (1.0)	34.4 (0.7)	28.6 (1.5)	45.4 (0.1)
1987	26.9 1.1	31.2 0.2	36.7 1.4	48.1 4.0	56.0 3.7	62.6 3.3	64.5 (2.0)	62.5 (2.4)	58.5 2.8	46.9 1.2	38.8 (3.7)	30.4 0.3	46.9 1.4
1988	27.9 2.1	33.9 2.9	39.2 3.9	47.0 2.9	53.8 1.5	62.5 3.2	66.6 0.1	66.9 2.0	56.5 0.8	-- --	39.0 3.9	29.9 (0.2)	-- --
1989	32.5 6.7	15.8 (15.2)	30.4 (4.9)	44.8 0.7	51.7 (0.6)	61.8 2.5	67 0.5	62.9 (2.0)	54.3 (1.4)	46.2 0.5	39.3 4.2	29.6 (0.5)	44.7 (0.8)
1990	33.8 8.0	30.6 (0.4)	36.4 1.1	46.2 2.1	49.7 (2.6)	57.7 (1.6)	66.5 0.0	65.6 0.7	61.9 6.2	--	--	--	--

\*\* FIRST LINE CONTAINS AVERAGES, SECOND LINE CONTAINS DEPARTURES FROM NORMAL (1951-1980)  
 -- INDICATES MISSING DATA FOR THAT MONTH  
 NUMBERS IN PARENTHESES () ARE NEGATIVE VALUES



#### SEELEY LAKE PRECIPITATION DATA \*\*

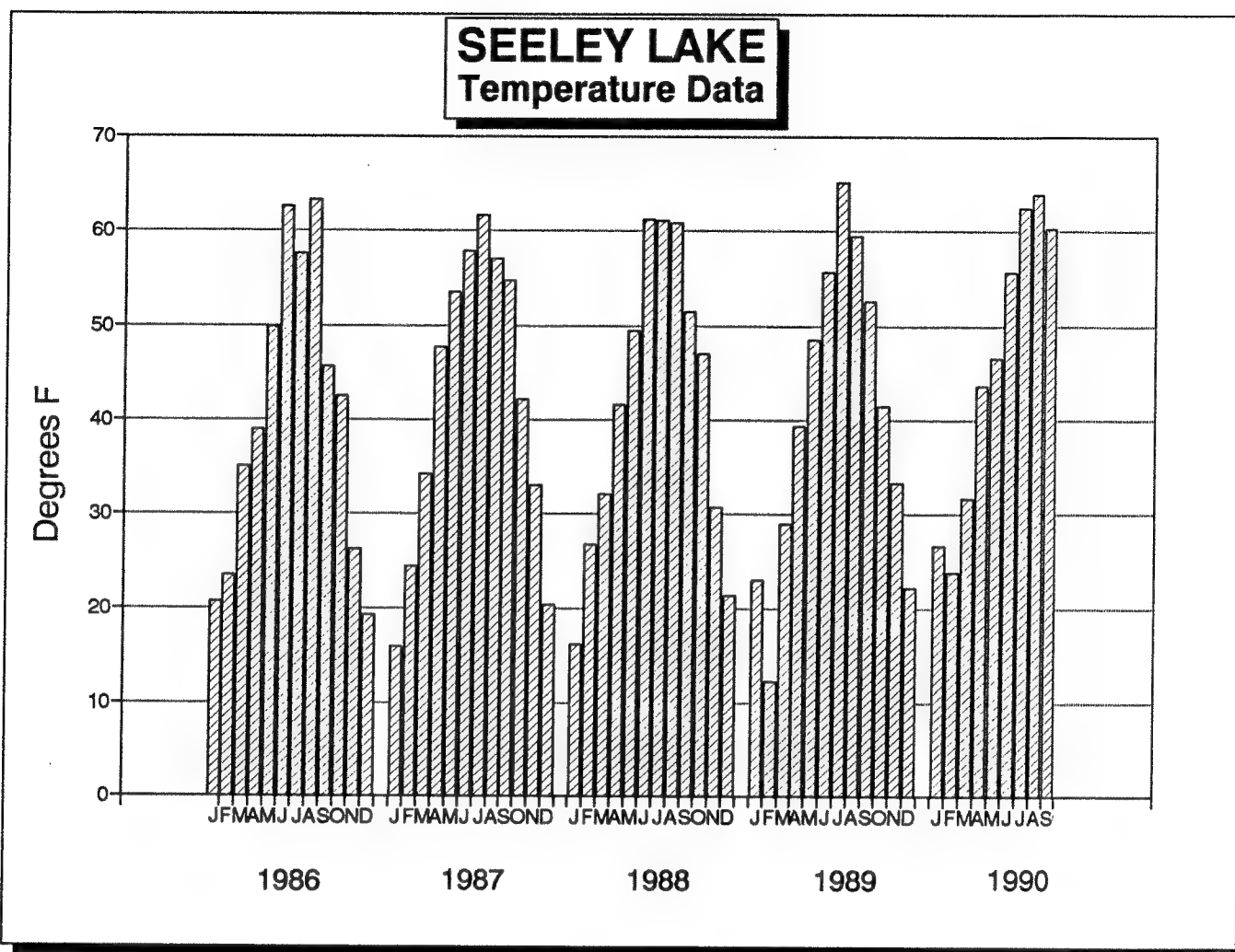
YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOT
1986	3.14 (0.11)	3.64 1.80 (1.28)	0.39 (1.28)	0.47 (0.91)	1.62 (0.29)	2.07 (0.12)	0.83 (0.13)	1.76 (0.59)	2.52 1.18 (0.71)	0.60 (0.71)	2.27 -- (1.77)	1.22 (1.77)	20.53 --
1987	0.91 --	0.49 (1.35)	2.08 0.41 (0.79)	0.59 (0.79)	1.52 (0.39)	1.85 (0.34)	1.39 0.43 (0.01)	1.16 (0.01)	0.07 (1.27)	0.04 (1.27)	0.63 (1.47)	1.16 (1.83)	11.89 --
1988	1.72 (1.53)	2.86 1.02 (0.37)	1.30 (0.37)	0.47 (0.91)	2.90 0.99 (0.91)	1.35 (0.84)	0.25 (0.71)	0.51 (0.66)	0.81 (0.53)	3.03 1.72 (1.22)	3.32 1.22 (0.99)	2.00 (0.99)	20.52 (1.59)
1989	2.14 (1.11)	2.07 (0.23)	2.80 1.13 (1.79)	3.17 1.79 (0.74)	1.17 (0.74)	1.26 (0.93)	2.57 1.61 (0.31)	2.77 1.60 (0.49)	0.89 (0.45)	1.79 0.48 (1.33)	2.26 0.16 (0.55)	2.44 (0.55)	25.33 3.22
1990	1.45 (1.80)	0.66 (1.18)	0.95 0.95 (0.75)	0.63 (0.75)	2.52 0.61 (0.08)	2.27 0.08 (0.31)	0.65 (0.31)	1.66 0.49 (1.33)	0.01 (1.33)	--	--	--	--

\*\* FIRST LINE CONTAINS TOTALS, SECOND LINE CONTAINS DEPARTURES FROM NORMAL (1951-1980)

-- INDICATES MISSING DATA FOR THAT MONTH

NUMBERS IN PARENTHESES ( ) ARE NEGATIVE VALUES



**FIGURE 4****SEELEY LAKE TEMPERATURE DATA \*\***

<u>YEAR</u>	<u>JAN</u>	<u>FEB</u>	<u>MAR</u>	<u>APR</u>	<u>MAY</u>	<u>JUN</u>	<u>JUL</u>	<u>AUG</u>	<u>SEP</u>	<u>OCT</u>	<u>NOV</u>	<u>DEC</u>	<u>TOT</u>
1986	20.6 1.2	23.4 (3.0)	35.0 4.7	38.9 (0.9)	49.8 1.0	62.5 6.4	57.5 (4.7)	63.2 2.1	45.6 (7.5)	42.5 (1.5)	26.2 (5.0)	19.3 (3.8)	40.4 (0.9)
1987	15.9 (3.5)	24.4 (2.0)	34.1 3.8	47.6 7.8	53.5 4.7	57.8 1.7	61.5 (0.9)	57.0 (4.1)	54.6 1.5	42.1 (1.9)	32.9 1.7	20.4 (2.7)	41.8 0.5
1988	16.1 (3.3)	26.7 0.3	31.9 1.6	41.6 1.8	49.4 0.6	61.1 5.0	61.0 (1.4)	60.8 (0.3)	51.4 (1.7)	46.9 2.9	30.6 (0.6)	21.3 (1.8)	41.6 0.3
1989	22.9 3.5	12.2 (14.2)	28.9 (1.4)	39.3 (0.5)	48.4 (0.4)	55.6 (0.5)	65.1 2.7	59.4 (1.7)	52.5 (0.6)	41.4 (2.6)	33.2 2.0	22.1 (1.0)	40.1 (1.2)
1990	26.6 7.2	23.7 (2.7)	31.6 1.3	43.6 3.8	46.5 (2.3)	55.6 (0.5)	62.3 (0.1)	63.9 2.8	60.2 7.1	--	--	--	--

\*\* FIRST LINE CONTAINS AVERAGES, SECOND LINE CONTAINS DEPARTURES FROM NORMAL (1951-1980)  
 -- INDICATES MISSING DATA FOR THAT MONTH  
 NUMBERS IN PARENTHESES () ARE NEGATIVE VALUES

The goals of the monitoring program were to determine the best method of tracking H. aquatilis populations over time, and to determine population trends with respect to management practices. Ocular population size estimates and percent cover of H. aquatilis within ponds appears to be the most suitable measure for several reasons: 1) it is an easy, fast, and simple way of sampling a large number of ponds and, 2) it causes the least disturbance within populations. The drawback to population estimation by this method is the difficulty of determining exact numbers of individuals when they are clumped, or in great enough numbers to be difficult to count.

Although cover gives a better measure of plant biomass than does number of individuals present, the line-intersect measurements are very time consuming for a small number of samples, and the disturbance caused by reading the transects is significant. This disturbance physically uproots the delicate H. aquatilis plants and other species within the pond, and probably affects subsequent transect readings.

In 1989 and 1990, frequency measurements were also added to the transect study of H. aquatilis. The frequency plots also indicated a reduction in estimated population sizes from 1989-1990, similar to but less severe than results given by the ocular population estimates and line-transect study.

In conclusion, for long-term monitoring of H. aquatilis, ocular population size estimation is the recommended method of study. Frequency measurements can also be used to quantitatively track population shifts from year to year, but repeated wading along the transect lines is required.

As hypothesized by Lesica (1990), the large population size fluctuations may be due to variation in pond drying times. Additional data regarding the actual dates of pond drying, are needed to more closely determine the nature of the observed fluctuations.

## V. TRANSPLANT EXPERIMENTS

**METHODS:** During September of 1989, soil plugs for transplant experiments were obtained from two ponds containing dense populations of H. aquatilis. The transplants were placed in four ponds that appeared to contain suitable habitat for H. aquatilis, but that had not been observed to support the species. Methods for the transplant study are described in Shelly and Schassberger (1990). The first year of quantitative monitoring of the four transplant ponds was completed. The geographic locations and elevations of the transplant ponds are:

<u>Pond</u>	<u>TOWNSHIP, RANGE, SEC, QTR SEC</u>	<u>ELEVATION</u>
POND A.)	T24N R17W Section 6, SE $\frac{1}{4}$ NW $\frac{1}{4}$ SW $\frac{1}{4}$ ;	955.8 m (3135').
POND B.)	T24N R18W Section 1, NE $\frac{1}{4}$ SE $\frac{1}{4}$ ;	942.1 m (3090').
POND C.)	T19N R17W Section 12, NW $\frac{1}{4}$ SE $\frac{1}{4}$ NW $\frac{1}{4}$ ;	1295.7 m (4250').
POND D.)	T19N R17W Section 12, SW $\frac{1}{4}$ SE $\frac{1}{4}$ NW $\frac{1}{4}$ ;	1291.2 m (4235').

The locations of these transplant sites are shown maps on pp. 16-17.

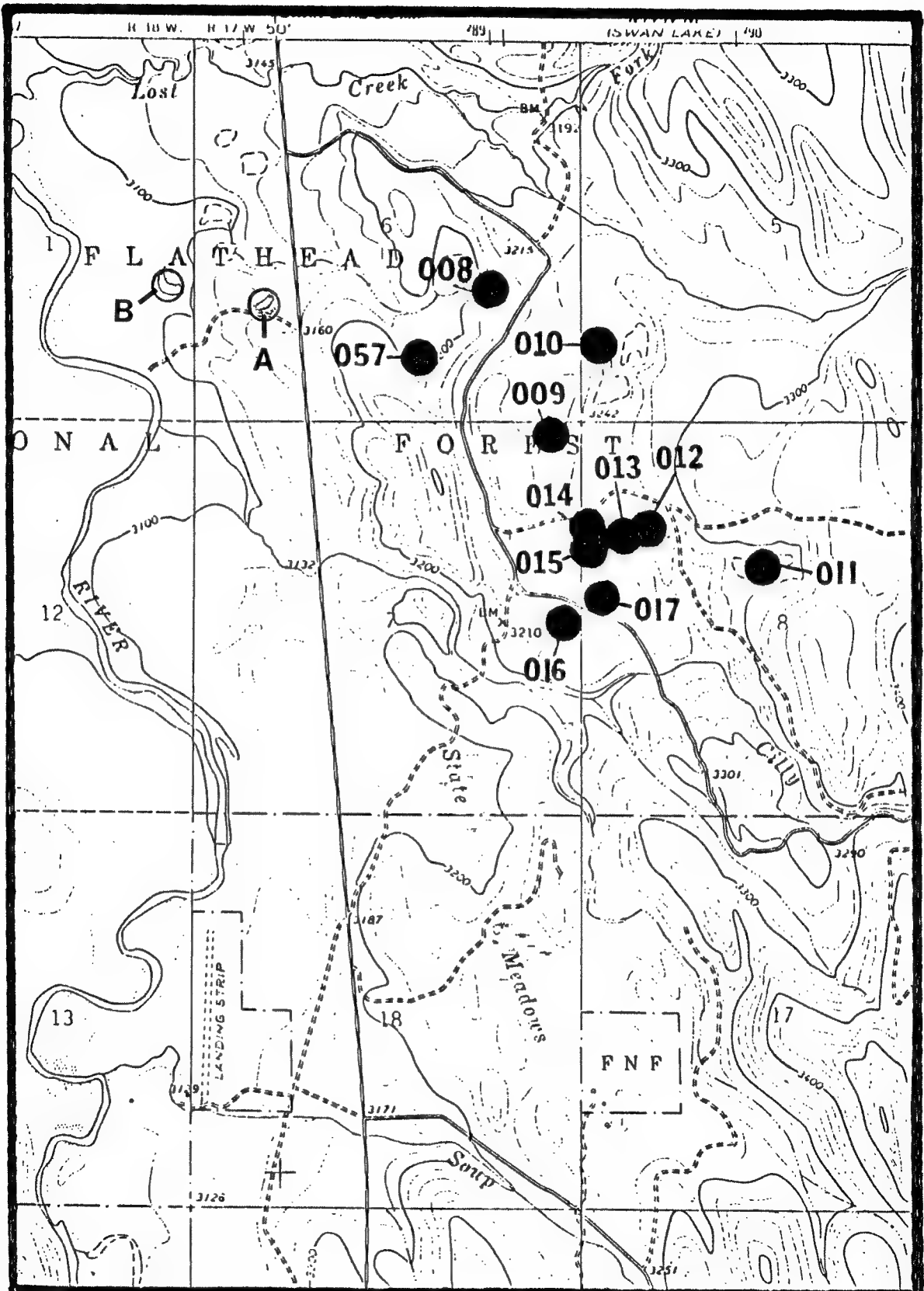
Transects at ponds A and B were read on 18 July 1990, and at ponds C and D on 19 July 1990. Transects were read by carefully wading out into the pond and visually searching along the length of the tape for H. aquatilis plants. After reading the transect, the rest of the area near the transect and the rest of the pond were searched for H. aquatilis. This ensured that any seeds of H. aquatilis in ponds C and D that might have floated away and established plants elsewhere were located.

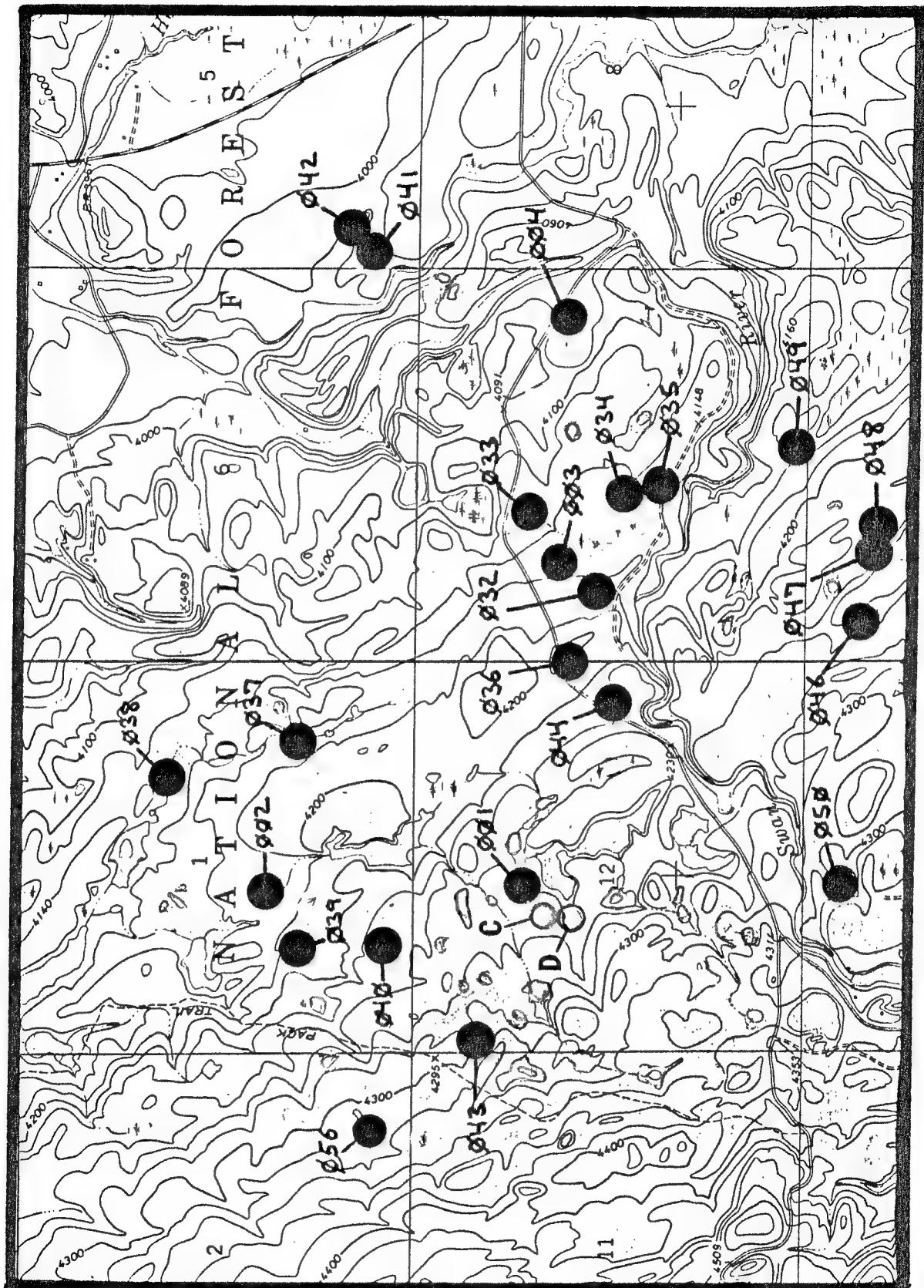
**RESULTS:** Howellia aquatilis was present in two of the four transplant ponds (A and B) in 1991. Howellia aquatilis was not observed in ponds C or D. Results for ponds A and B are as are in Table 5, p. 18, and Table 6, p. 19, respectively. Plants were located very near the points where the soil cores were placed along the tape.

**DISCUSSION:** As stated in the earlier report (Shelly and Schassberger 1990), two of the four ponds receiving soil plugs still contained water on the transplant date (C and D), and it is unlikely that these ponds dried out much further prior to freezing. The transects in the other ponds (A and B) were not under water on the transfer date. The results of the field transplants appear to confirm the observed laboratory results that H. aquatilis is not capable of germinating under water (Lesica 1990). This may help to explain why population sizes fluctuate from year to year. If ponds do not dry out in the fall of a particular year, even if fruiting and seed production are high, the seeds would not germinate and the population would be reduced in size the following year.

A small number of plants were established in transplant ponds A and B in 1990 (32 and 5 plants, respectively). Both ponds contained plants that were reproductive. However, as noted at the bottom of Tables 5 and 6, Pond A had a large number of flowering plants with submergent or emergent flowers or both, while Pond B contained only five plants with submergent flowers. While the transplants to ponds A and B could be considered a success in 1990, it remains to be seen whether or not these small H. aquatilis populations are present next year or thereafter. If these transplant populations remain viable, it might be hypothesized that dispersal limitations keep H. aquatilis from establishing in currently uninhabited but suitable ponds.

MONTANA





USGS Cygnet Lake Quadrangle (7.5')

● = element occurrences

Howellia aquatilis

○ = transplant ponds (sites receiving soil plugs)

**Table 5.** Number and location of plants in transplant pond A in 1990.

**POND A**

Date Read: 18 July 1991

Tape Point (m)	Results
1.6	Three plants: 2 w/ submergent flowers, 1 w/ both submergent and emergent flowers.
3.1	Two plants: 1 w/ submergent flowers, 1 w/ both submergent and emergent flowers.
6.0	Four plants: 3 w/ emergent flowers, 1 vegetative plant.
8.4	No plants observed.
10	One plant: w/ emergent flower.
12	No plants observed.
14	One plant: w/ submergent and emergent flowers.
16	No plants observed.
18	Four plants: all with w/ submergent flowers.
20	Three plants: large, all w/ submergent and emergent flowers.
22	Two plants: both w/ submergent and emergent flowers.
24	Six plants: 3 uprooted, all 6 w/ submergent and emergent flowers.
26	One plant: w/ emergent flowers.
28	Two plants: both w/ submergent and emergent flowers.
30	Three plants: 2 w/ submergent flowers, 1 w/ submergent and emergent flowers.

32 plants total

17 w/ submergent and emergent flowers or fruits  
 9 w/ only submergent flowers  
 5 with only emergent flowers  
 1 vegetative plant

**Table 6.** Number and location of plants in transplant pond B in 1990.

**Pond B**

Date Read: 18 July 1990

Tape Point (m)	Results
2	One plant: w/ submergent flowers and buds.
4	One plant: w/ submergent fruits.
6	No plants observed.
8	No plants observed.
10	No plants observed.
12	One detached plant: w/ submergent buds and fruit.
13	No plants observed.
14	One plant: w/ submergent flower bud.
15	No plants observed.
16	No plants observed.
17	One plant: w/ submergent flowers and fruits.
20	No plants observed.
22	No plants observed.
24	No plants observed.

5 plants total

5 plants w/ submergent flowers, fruits or buds  
0 plants w/ emergent flowers

On the other hand, if the transplant populations do not persist, then it is possible that transplant ponds were unsuitable for H. aquatilis due to one or more environmental factors.

All four transplant ponds should be re-surveyed in 1991, and preferably through several more seasons.

## VI. STUDY RECOMMENDATIONS

During continuation of these studies in 1991, the following goals should be emphasized:

- 1.) estimate population size, and percent cover of H. aquatilis within ponds, for 26 populations.
- 2.) conduct studies of the pond drying dates for selected locations to determine more closely the influence that this factor may have on the abundance of H. aquatilis in the subsequent year.
- 3.) monitor the transplant locations (2nd year).
- 4.) survey ponds that have suitable habitat in the Lake Five area near West Glacier, Montana.
- 5.) continue frequency studies in the five ponds containing line transects.



**VII. ELEMENT OCCURRENCE PRINT-OUTS AND MAPS: NEW SITES**

Element Occurrence Record  
Howellia aquatilis

22

Occurrence number: 058

Global rank: G2      Forest Service status: SENSITIVE LIST  
State rank: S2      Federal Status: C1

Survey site name: SALMON PRAIRIE  
EO rank: BC  
EO rank comments: SMALL POPULATION, SOME PHALARIS ON  
MARGINS; ONLY 1 POND. LITTLE EVIDENCE OF  
RECENT DISTURBANCE.

County: LAKE

USGS quadrangle: SALMON PRAIRIE

Township-range: 022N017W    Section: 16      Precision: S  
Township-range comments: CENTER

Survey date: 1990-08-27      Elevation: 3555  
First observation: 1990      Slope/aspect: LEVEL  
Last observation: 1990-08-27      Size (acres): 1

Location:

CA. 2.4 AIR MILES NORTH OF SALMON PRAIRIE. NORTH OF SALMON PRAIRIE  
TAKE STATE HWY. 83 NORTH CA. 1.5 MILES TO F.S. ROAD #9769. GO EAST CA.  
0.5 MILE; POND IS NORTH OF ROAD CA. 0.5 MILE.

Element occurrence data:

11-50 PLANTS IN FRUIT (SEE COMMENTS).

General site description:

SMALL GLACIAL POTHOLE SURROUNDED BY DOUGLAS FIR-LARCH-LODGEPOLE  
FOREST. PEAT SUBSTRATE. POND VEGETATION IS CAREX VESICARIA, SIUM  
SUAVE, POTAMOGETON GRAMINEUS.

Land owner/manager:

PRIVATELY OWNED LAND (INDIVIDUAL OR CORPORATE)

Comments:

BAD YEAR (1990) FOR HOWELLIA; LATE SEASON COUNTS UNRELIABLE.

Information source:

LESICA, P. DIVISION OF BIOLOGICAL SCIENCES, UNIV. OF MONTANA,  
MISSOULA, MT 59812.

Element Occurrence Record  
Howellia aquatilis

23

Occurrence number: 059

Global rank: G2      Forest Service status: SENSITIVE LIST  
State rank: S2      Federal Status: C1

Survey site name: LOST CREEK - CILLY CREEK PONDS  
EO rank: C  
EO rank comments: SMALL POND, VERY SHALLOW, LARGE AREAS OF  
CAREX VESICARIA.

County: LAKE

USGS quadrangle: CILLY CREEK

Township-range: 024N017W    Section: 07      Precision: S  
Township-range comments: SE4SE4NE4, NE4NE4SE4

Survey date:	1990-07-17	Elevation:	3235
First observation:	1990	Slope/aspect:	
Last observation:	1990-07-17	Size (acres):	1

Location:

SWAN VALLEY, 0.61 AIR MILE EAST OF STATE HWY. 83, 0.18 AIR MILE NORTH  
OF CILLY CREEK, AND CA. 5 AIR MILES SSE OF SWAN LAKE (TOWN).

Element occurrence data:

CA. 150 PLANTS, 80% OF WHICH ARE ALONG A LOG IN CENTER OF POND.

General site description:

SMALL POND (CA. 30m x 70m), DOMINATED BY CAREX VESICARIA; MORE OPEN  
AREAS WITH SIUM SUAVE. EDGE OF POND SURROUNDED BY LARGE COTTONWOODS,  
WILLOW, ALDER, AND PAPER BIRCH. POND IS LESS THAN 2 FT. DEEP.

Land owner/manager:

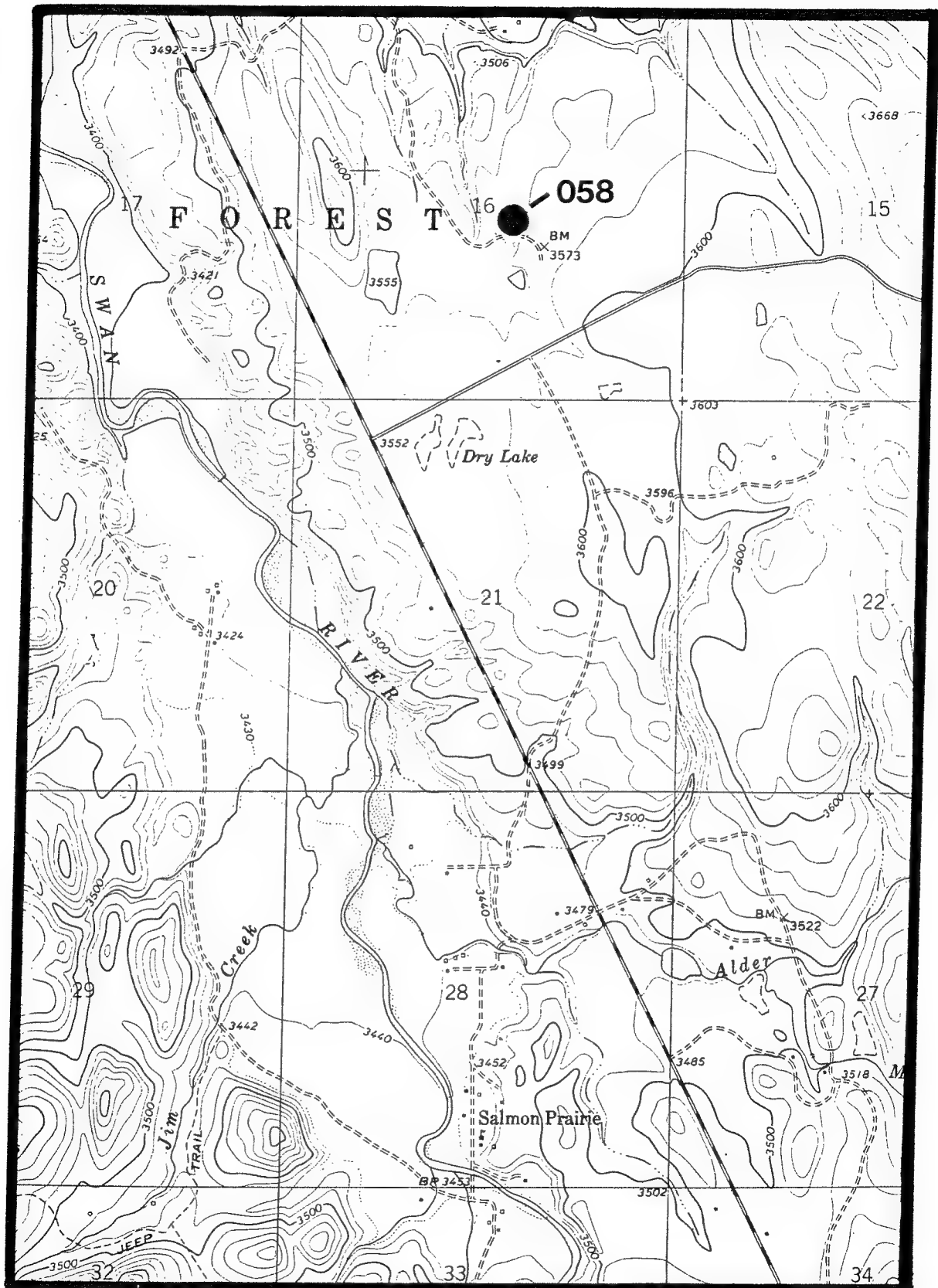
FLATHEAD NATIONAL FOREST, SWAN LAKE RANGER DISTRICT

Comments:

SIGHT RECORD - NO VOUCHER SPECIMEN.

Information source:

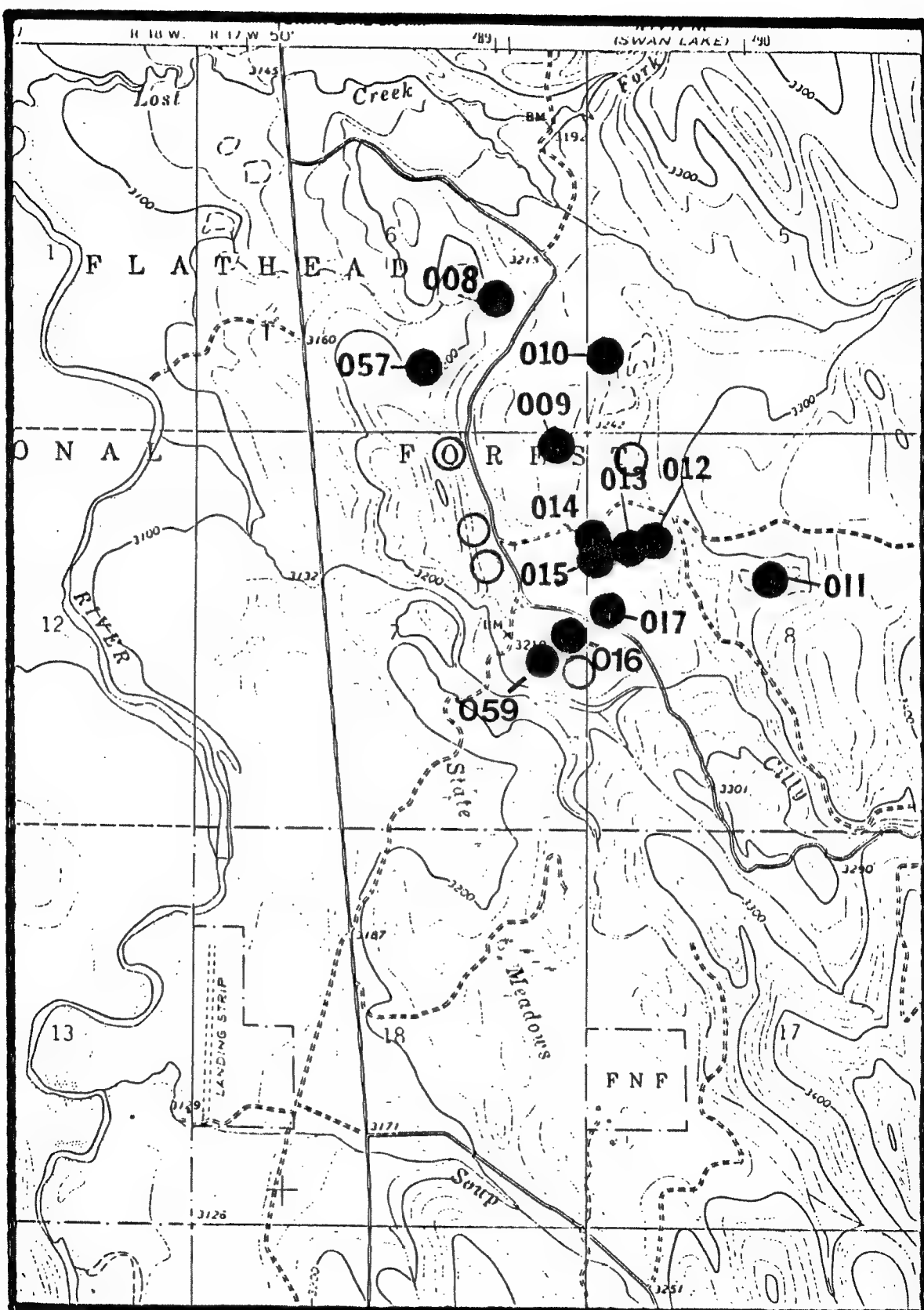
SCHASSBERGER, L.A. MONTANA NATURAL HERITAGE PROGRAM, 1515 E. SIXTH  
AVENUE, HELENA, MT 59620.



USGS Salmon Prairie Quadrangle (7.5')

Howellia aquatilis

● -element occurrence



VIII. ELEMENT OCCURRENCE PRINT-OUTS: RESURVEYED SITES

Element Occurrence Record  
Howellia aquatilis

27

Occurrence number: 001

Global rank: G2      Forest Service status: SENSITIVE LIST  
State rank: S2      Federal Status: C1

Survey site name: LINDBERGH LAKE  
EO rank: D  
EO rank comments: SMALL POPULATION; NORTH MARGIN OF POND  
IMPACTED BY LOGGING.

County: MISSOULA

USGS quadrangle: CYGNET LAKE

Township-range: 019N017W    Section: 12      Precision: S  
Township-range comments: NE4SE4NW4

Survey date: 1984-07-15      Elevation: 4230  
First observation: 1984      Slope/aspect: LEVEL  
Last observation: 1990-07-19      Size (acres): 2

Location:

SWAN VALLEY, 0.68 AIR MILES NNE. FROM THE FIRST FORK ON LINDBERGH LAKE  
ROAD, CA. 2.5 MILES WEST FROM ST. HWY. 83.

Element occurrence data:

1990: 27 PLANTS; 1989: 300-400 PLANTS; 1987: EST. 75-100+ PLANTS;  
NORTH END OF POND IMPACTED BY LOGGING, WITH SOME SLASH PILED INTO THE  
WATER.

General site description:

GLACIAL POTHOLE; WITH CAREX VESICARIA, SIUM SUAVE, RANUNCULUS  
GMELINII; POPULUS TRICHOCARPA, PINUS CONTORTA, LARIX OCCIDENTALIS,  
SALIX SP. AROUND POND.

Land owner/manager:

FLATHEAD NATIONAL FOREST, SWAN LAKE RANGER DISTRICT

Comments:

Information source:

SCHASSBERGER, L. A. 1990. MONITORING AND FIELD SURVEYS OF 10-13 AND  
17-19 JULY (HOWELLIA AQUATILIS).

Element Occurrence Record  
Howellia aquatilis

28

Occurrence number: 006

Global rank: G2      Forest Service status: SENSITIVE LIST  
State rank: S2      Federal Status: C1

Survey site name: CONDON CREEK  
EO rank: C  
EO rank comments: LARGE POPULATION; AREA THREATENED BY  
LOGGING.

County: MISSOULA

USGS quadrangle: CONDON

Township-range: 021N016W    Section: 18      Precision: S  
Township-range comments: NE4NW4SW4

Survey date: 1986-07-14      Elevation: 3740  
First observation: 1986      Slope/aspect: LEVEL  
Last observation: 1990-07-11      Size (acres): 1

Location:

SWAN VALLEY, WEST BASE OF SWAN RANGE UPLIFT, 3.5 AIR MILES NORTH OF  
CONDON, 2.1 AIR MILES EAST OF ST. HWY. 83, 0.1 AIR MILES SOUTH OF  
CONDON CREEK.

Element occurrence data:

1990: 500-1000 PLANTS; 1989 AND 1987: EST. 1000-2000 PLANTS (MANY  
PLANTS DISTURBED BY MOOSE AND/OR WATERFOWL ACTIVITY); AREA IS ACTIVELY  
THREATENED BY LOGGING ROAD CONSTRUCTION AND TIMBER HARVESTING.

General site description:

VERNAL POND, IN PINUS PONDEROSA/LARIX OCCIDENTALIS FOREST; WITH SIUM  
SUAVE, CAREX VESICARIA, RANUNCULUS AQUATILIS, VERONICA CATENATA,  
CALLITRICHE HETEROPHYLLA.

Land owner/manager:

FLATHEAD NATIONAL FOREST, SWAN LAKE RANGER DISTRICT

Comments:

VOUCHER-LESICA, P. (3965), 1986, SPECIMEN #104450 (MONTU).

Information source:

SCHASSBERGER, L. A. 1990. MONITORING AND FIELD SURVEYS OF 10-13 AND  
17-19 JULY (HOWELLIA AQUATILIS).



Element Occurrence Record  
Howellia aquatilis

29

Occurrence number: 007

Global rank: G2      Forest Service status: SENSITIVE LIST  
State rank: S2      Federal Status: C1

Survey site name: SWAN RIVER WEST  
EO rank: AB  
EO rank comments: VERY LARGE POPULATION; NEARBY STATE LAND  
IS LOGGED.

County: LAKE

USGS quadrangle: CILLY CREEK

Township-range: 024N018W    Section: 14      Precision: S  
Township-range comments: SW4SE4SE4

Survey date: 1987-07-01      Elevation: 3190  
First observation: 1987      Slope/aspect: LEVEL  
Last observation: 1990-07-17      Size (acres): 1

Location:

WEST SIDE OF SWAN VALLEY, 1.4 AIR MILES WEST OF ST. HWY. 83; 0.57 AIR  
MILE WEST OF SWAN RIVER; CA. 6.5 AIR MILES SOUTH OF SWAN LAKE (TOWN).

Element occurrence data:

1990: 500-1000 PLANTS; 1989: 1000-2000 PLANTS; 1987: ABOUT 3000-4000  
PLANTS, POSSIBLY MORE PLANTS; VERY DENSE, AND FORMING MATS, IN WEST  
POND; THE TWO PONDS, WHICH ARE SEPARATED BY A SALIX BORDER, ARE JOINED  
BY HIGHER WATER IN THE SPRING.

General site description:

IN TWO SMALL, ADJACENT GLACIAL POTHoles, IN 1-2 FEET OF WATER; WITH  
CAREX VESICARIA, EQUISETUM FLUVIATILE, SIUM SUAVE; POPULUS  
TRICHOCARPA, BETULA PAPYRIFERA AROUND PONDS.

Land owner/manager:

FLATHEAD NATIONAL FOREST, SWAN LAKE RANGER DISTRICT

Comments:

VOUCHER-SHELLY, J.S. (1356), 1987, MONTU. pH = 7.20 IN WEST POND.

Information source:

SCHASSBERGER, L. A. 1990. MONITORING AND FIELD SURVEYS OF 10-13 AND  
17-19 JULY (HOWELLIA AQUATILIS).

Element Occurrence Record  
Howellia aquatilis

30

Occurrence number: 008

Global rank: G2      Forest Service status: SENSITIVE LIST  
State rank: S2      Federal Status: C1

Survey site name: LOST CREEK-CILLY CREEK PONDS  
EO rank: B  
EO rank comments: LARGE, VIGOROUS POPULATION; IN GOOD  
CONDITION HABITAT.

County: LAKE

USGS quadrangle: CILLY CREEK

Township-range: 024N017W    Section: 06      Precision: S  
Township-range comments: N2SE4

Survey date: 1987-07-07      Elevation: 3190  
First observation: 1987      Slope/aspect: LEVEL  
Last observation: 1990-07-18      Size (acres): 2

Location:

SWAN VALLEY, CA. 4.5 AIR MILES SSE. OF SWAN LAKE (TOWN); 0.5 AIR MILES  
EAST OF ST. HWY. 83; 0.5 AIR MILES SSE. OF CONFLUENCE OF NORTH AND  
SOUTH FORKS LOST CREEK.

Element occurrence data:

1990: 40+ PLANTS; 1989: 1000-1500 PLANTS; 1987: EST. 2000-3000 PLANTS,  
IN A SINGLE POND; SURROUNDED BY A RELATIVELY UNDISTURBED FOREST, WHICH  
WAS REPORTEDLY LIGHTLY SELECTIVELY LOGGED IN ABOUT 1910.

General site description:

THROUGHOUT A GLACIAL POTHOLE POND, BOTTOM SOIL OF CONSOLIDATED CLAY  
MUCK; WITH SIUM SUAVE, RANUNCULUS AQUATILIS, GLYCERIA BOREALIS, CAREX  
VESICARIA, POTAMOGETON, ELEOCHARIS.

Land owner/manager:

FLATHEAD NATIONAL FOREST, SWAN LAKE RANGER DISTRICT

Comments:

VOUCHER-SHELLY, J.S. (1358) AND ANNE MORLEY, 1987, MONTU. pH=7.57.

Information source:

SCHASSBERGER, L. A. 1990. MONITORING AND FIELD SURVEYS OF 10-13 AND  
17-19 JULY (HOWELLIA AQUATILIS).

Element Occurrence Record  
Howellia aquatilis

31

Occurrence number: 009

Global rank: G2      Forest Service status: SENSITIVE LIST  
State rank: S2      Federal Status: C1

Survey site name: LOST CREEK-CILLY CREEK PONDS  
EO rank: C  
EO rank comments: MEDIUM-SIZED POPULATION, ADJACENT FOREST  
PREVIOUSLY LOGGED.

County: LAKE

USGS quadrangle: CILLY CREEK

Township-range: 024N017W    Section: 07      Precision: S  
Township-range comments: NE4NE4NE4

Survey date: 1987-07-01      Elevation: 3250  
First observation: 1987      Slope/aspect: LEVEL  
Last observation: 1990-07-09      Size (acres): 3

Location:

SWAN VALLEY, 0.6 AIR MILES EAST OF ST. HWY. 83, 0.6 AIR MILES SOUTH OF  
SOUTH FORK LOST CREEK, CA. 5.0 AIR MILES SSE OF SWAN LAKE (TOWN).

Element occurrence data:

1990: 250 PLANTS (SEVERAL AREAS HIGH COVER OF LEMNA MINOR); 1989:  
500-1000 PLANTS (SPECIES DOES NOT OCCUPY ALL OF THE AVAILABLE,  
SUITABLE HABITAT AT THIS SITE); 1987: EST. 500-600 PLANTS; AREAS  
AROUND SOUTH AND EAST SIDES OF POND, CLEARCUT CA. 15 YEARS AGO.

General site description:

IN SHALLOW WATER OF A GLACIAL POND, ORGANIC CLAY BOTTOM; WITH  
EQUISETUM FLUVIATILE, CAREX VESICARIA, SIUM SUAVE; POPULUS TRICHOCARPA  
BORDERING POND.

Land owner/manager:

FLATHEAD NATIONAL FOREST, SWAN LAKE RANGER DISTRICT

Comments:

VOUCHER-SHELLY, J.S. (1357) AND ANNE MORLEY, 1987, MONTU.

Information source:

SCHASSBERGER, L. A. 1990. MONITORING AND FIELD SURVEYS OF 10-13 AND  
17-19 JULY (HOWELLIA AQUATILIS).

Element Occurrence Record  
Howellia aquatilis

32

Occurrence number: 012

Global rank: G2      Forest Service status: SENSITIVE LIST  
State rank: S2      Federal Status: C1

Survey site name: LOST CREEK-CILLY CREEK PONDS  
EO rank: C  
EO rank comments: MODERATE-SIZED POPULATION; SURROUNDING  
FOREST LOGGED.

County: LAKE

USGS quadrangle: CILLY CREEK

Township-range: 024N017W    Section: 08      Precision: S  
Township-range comments: NE4SW4NW4, SE4NW4NW4

Survey date: 1987-07-07      Elevation: 3235  
First observation: 1987      Slope/aspect: LEVEL  
Last observation: 1990-07-12      Size (acres): 2

Location:

SWAN VALLEY, 0.83 AIR MILES EAST OF ST. HWY 83, 0.37 AIR MILES NORTH  
OF CILLY CREEK, CA. 5.0 AIR MILES SSE OF SWAN LAKE (TOWN).

Element occurrence data:

1990: EST. 35 PLANTS (Nuphar VERY ABUNDANT, H. AQUATILIS SCATTERED  
AMONG SIUM SUAVE); 1989: 16 PLANTS; 1987: EST. 400-500 PLANTS; MUCH OF  
POND HAS NO VEGETATION; LOGGING HAS OCCURRED AROUND POND.

General site description:

IN SHALLOW WATER OF A GLACIAL DEPRESSION, SOILS FAIRLY UNCONSOLIDATED;  
WITH NUPHAR VARIEGATUM, SIUM SUAVE, POTAMOGETON SP., POPULUS  
TRICHOCARPA, BETULA PAPYRIFERA AROUND POND.

Land owner/manager:

FLATHEAD NATIONAL FOREST, SWAN LAKE RANGER DISTRICT

Comments:

SIGHT RECORD, NO VOUCHER SPECIMEN COLLECTED; SITE SURVEYED WITH ANNE  
MORLEY (SWAN LAKE, MT).

Information source:

SCHASSBERGER, L. A. 1990. MONITORING AND FIELD SURVEYS OF 10-13 AND  
17-19 JULY (HOWELLIA AQUATILIS).

Element Occurrence Record  
Howellia aquatilis

33

Occurrence number: 013

Global rank: G2      Forest Service status: SENSITIVE LIST  
State rank: S2      Federal Status: C1

Survey site name: LOST CREEK-CILLY CREEK PONDS  
EO rank: C  
EO rank comments: LARGE POPULATION; SURROUNDING FOREST  
LOGGED.

County: LAKE

USGS quadrangle: CILLY CREEK

Township-range: 024N017W    Section: 08      Precision: S  
Township-range comments: N2SW4NW4

Survey date: 1987-07-07      Elevation: 3240  
First observation: 1987      Slope/aspect: LEVEL  
Last observation: 1990-07-19      Size (acres): 2

Location:

SWAN VALLEY, 0.79 AIR MILES EAST OF ST. HWY 83, 0.36 AIR MILES NORTH  
OF CILLY CREEK, CA. 5.0 AIR MILES SSE OF SWAN LAKE (TOWN).

Element occurrence data:

1990: 33 PLANTS; 1989: 500-1000 PLANTS; 1987: EST. 1000-1500 PLANTS;  
LOGGING HAS OCCURRED AROUND POND.

General site description:

IN SHALLOW WATER OF A GLACIAL DEPRESSION; OPENINGS AMONG CAREX  
VESICARIA, WITH SIUM SUAVE, ELEOCHARIS PALUSTRIS, CAREX ROSTRATA;  
POPULUS TRICHOCARPA, BETULA PAPYRIFERA AROUND POND

Land owner/manager:

FLATHEAD NATIONAL FOREST, SWAN LAKE RANGER DISTRICT

Comments:

VOUCHER - SHELLY, J.S. (1359) AND ANNE MORLEY, 1987, MONTU.

Information source:

SCHASSBERGER, L. A. 1990. MONITORING AND FIELD SURVEYS OF 10-13 AND  
17-19 JULY (HOWELLIA AQUATILIS).

Element Occurrence Record  
Howellia aquatilis

34

Occurrence number: 014

Global rank: G2      Forest Service status: SENSITIVE LIST  
State rank: S2      Federal Status: C1

Survey site name: LOST CREEK-CILLY CREEK PONDS  
EO rank: C  
EO rank comments: MODERATE-SIZED POPULATION; SURROUNDING  
FOREST LOGGED.

County: LAKE

USGS quadrangle: CILLY CREEK

Township-range: 024N017W    Section: 08      Precision: S  
Township-range comments: NW4SW4NW4

Survey date: 1987-07-07      Elevation: 3245  
First observation: 1987      Slope/aspect: LEVEL  
Last observation: 1990-07-12      Size (acres): 2

Location:

SWAN VALLEY, 0.68 AIR MILES EAST OF ST. HWY 83, 0.44 AIR MILES NORTH  
OF CILLY CREEK, CA. 5.0 AIR MILES SSE OF SWAN LAKE (TOWN).

Element occurrence data:

1990: 150-250 PLANTS (SEVERAL AREAS OF DENSE POTAMOGETON); 1989: 500+  
PLANTS; 1987: EST. 300-400 PLANTS; LOGGING HAS OCCURRED IN ADJACENT  
FORESTS.

General site description:

IN SHALLOW WATER OF A GLACIAL DEPRESSION; AROUND LOGS & IN OPENINGS  
AMONG CAREX VESICARIA, WITH SIUM SUAVE, POTAMOGETON SPP; POPULUS  
TRICHOCARPA, P. TREMULOIDES, BETULA PAPYRIFERA.

Land owner/manager:

FLATHEAD NATIONAL FOREST, SWAN LAKE RANGER DISTRICT

Comments:

SIGHT RECORD, NO VOUCHER SPECIMEN COLLECTED; SITE SURVEYED WITH ANNE  
MORLEY (SWAN LAKE, MT); pH = 7.00.

Information source:

SCHASSBERGER, L. A. 1990. MONITORING AND FIELD SURVEYS OF 10-13 AND  
17-19 JULY (HOWELLIA AQUATILIS).

Element Occurrence Record  
Howellia aquatilis

35

Occurrence number: 016

Global rank: G2      Forest Service status: SENSITIVE LIST  
State rank: S2      Federal Status: C1

Survey site name: LOST CREEK-CILLY CREEK PONDS  
EO rank: C  
EO rank comments: MODERATE-SIZED POPULATION; ADJACENT TO  
LOGGING ROAD.

County: LAKE

USGS quadrangle: CILLY CREEK

Township-range: 024N017W    Section: 07      Precision: S  
Township-range comments: SE4SE4NE4, NE4NE4SE4

Survey date: 1987-07-07      Elevation: 3235  
First observation: 1987      Slope/aspect: LEVEL  
Last observation: 1990-07-12      Size (acres): 2

Location:

SWAN VALLEY, 0.61 AIR MILES EAST OF ST. HWY 83, 0.18 AIR MILES NORTH  
OF CILLY CREEK, CA. 5.0 AIR MILES SSE OF SWAN LAKE (TOWN).

Element occurrence data:

1990: 300-500 PLANTS (CAREX VESICARIA VERY DENSE; H. AQUATILIS ONLY IN  
SHALLOW OPEN WATER AT EDGES OF POND, EMERGENT FLOWERS) 1989: 1000-1500  
PLANTS; 1987: EST. 400+ PLANTS; ADJACENT TO LOGGING ROAD.

General site description:

IN SHALLOW WATER OF A GLACIAL DEPRESSION; WITH CAREX VESICARIA, SIUM  
SUAVE; POPULUS TRICHOCARPA BORDERING POND.

Land owner/manager:

FLATHEAD NATIONAL FOREST, SWAN LAKE RANGER DISTRICT

Comments:

SIGHT RECORD, NO VOUCHER SPECIMEN COLLECTED; SITE SURVEYED WITH ANNE  
MORLEY (SWAN LAKE, MT).

Information source:

SCHASSBERGER, L. A. 1990. MONITORING AND FIELD SURVEYS OF 10-13 AND  
17-19 JULY (HOWELLIA AQUATILIS).

Element Occurrence Record  
Howellia aquatilis

36

Occurrence number: 017

Global rank: G2      Forest Service status: SENSITIVE LIST  
State rank: S2      Federal Status: C1

Survey site name: LOST CREEK-CILLY CREEK PONDS  
EO rank: D  
EO rank comments: SMALL POPULATION; ADJACENT TO LOGGING  
ROAD.

County: LAKE

USGS quadrangle: CILLY CREEK

Township-range: 024N017W    Section: 08      Precision: S  
Township-range comments: SW4SW4NW4

Survey date: 1987-07-07      Elevation: 3245  
First observation: 1987      Slope/aspect: LEVEL  
Last observation: 1990-07-12      Size (acres): 3

Location:

SWAN VALLEY, 0.71 AIR MILES EAST OF ST. HWY 83, 0.25 AIR MILES NORTH  
OF CILLY CREEK, CA. 5.0 AIR MILES SSE OF SWAN LAKE (TOWN).

Element occurrence data:

1990: 0 PLANTS (WATER POSSIBLY TOO DEEP, CAREX VESICARIA DENSE); 1989:  
10-20; 1987: EST. 10-12 PLANTS; ADJACENT TO LOGGING ROAD; THIS  
DEPRESSION WAS MUCH DRYER THAN THE OTHERS, HOWELLIA AQUATILIS PRESENT  
IN A FEW PUDDLES; HABITAT MAY BE MORE ADVANCED SUCCESSIONALLY THAN  
NEARBY PONDS.

General site description:

IN SHALLOW WATER OF A GLACIAL DEPRESSION; WITH CAREX VESICARIA, SIUM  
SUAVE, POTAMOGETON, CAREX ROSTRATA, POTENTILLA PALUSTRIS; POPULUS  
TREMULOIDES AROUND POND.

Land owner/manager:

FLATHEAD NATIONAL FOREST, SWAN LAKE RANGER DISTRICT

Comments:

SIGHT RECORD; NO VOUCHER SPECIMEN COLLECTED; SITE SURVEYED WITH ANNE  
MORLEY (SWAN LAKE, MT).

Information source:

SCHASSBERGER, L. A. 1990. MONITORING AND FIELD SURVEYS OF 10-13 AND  
17-19 JULY (HOWELLIA AQUATILIS).



Element Occurrence Record  
Howellia aquatilis

37

Occurrence number: 020

Global rank: G2      Forest Service status: SENSITIVE LIST  
State rank: S2      Federal Status: C1

Survey site name: CONDON CREEK  
EO rank: C

EO rank comments: LARGE POPULATION; AREA BEING LOGGED.

County: MISSOULA

USGS quadrangle: CONDON

Township-range: 021N016W    Section: 18      Precision: S  
Township-range comments: SW4NE4SW4

Survey date: 1987-07-02      Elevation: 3740  
First observation: 1987      Slope/aspect: LEVEL  
Last observation: 1990-07-18      Size (acres): 2

Location:

SWAN VALLEY, 3.3 AIR MILES NORTH OF CONDON, 2.13 AIR MILES EAST OF ST.  
HWY 83, 0.25 AIR MILES SOUTH OF CONDON CREEK.

Element occurrence data:

1990: 190+ PLANTS; 1989: 1000-1500 PLANTS; 1987: EST. 1000 PLANTS;  
NEARBY FORESTS RECENTLY LOGGED.

General site description:

IN SHALLOW WATER OF A GLACIAL DEPRESSION; WITH SIUM SUAVE, CAREX  
VESICARIA; POPULUS TRICHOCARPA, PINUS PONDEROSA, LARIX OCCIDENTALIS IN  
SURROUNDING FOREST.

Land owner/manager:

FLATHEAD NATIONAL FOREST, SWAN LAKE RANGER DISTRICT

Comments:

SIGHT RECORD, NO VOUCHER SPECIMEN COLLECTED. pH=7.28.

Information source:

SCHASSBERGER, L. A. 1990. MONITORING AND FIELD SURVEYS OF 10-13 AND  
17-19 JULY (HOWELLIA AQUATILIS).

Element Occurrence Record  
Howellia aquatilis

38

Occurrence number: 022

Global rank: G2      Forest Service status: SENSITIVE LIST  
State rank: S2      Federal Status: C1

Survey site name: CONDON CREEK  
EO rank: C  
EO rank comments: MEDIUM-SIZED POPULATION; AREA BEING  
LOGGED.

County: MISSOULA

USGS quadrangle: CONDON

Township-range: 021N016W    Section: 18      Precision: S  
Township-range comments: SW4NE4SW4

Survey date: 1987-07-02      Elevation: 3750  
First observation: 1987      Slope/aspect: LEVEL  
Last observation: 1990-07-12      Size (acres): 1

Location:

SWAN VALLEY, 3.28 AIR MILES NORTH OF CONDON, 2.18 AIR MILES EAST OF  
ST. HWY 83, 0.27 AIR MILES SOUTH OF CONDON CREEK.

Element occurrence data:

1990: 60-100 PLANTS (WATER DEEP RED-YELLOW, SIUM SUAVE SPARSE); 1989:  
500-1000 PLANTS; 1987: EST. 200 PLANTS; NEARBY FORESTS RECENTLY  
LOGGED.

General site description:

IN SHALLOW WATER OF A GLACIAL DEPRESSION; WITH SIUM SUAVE, CAREX  
VESICARIA; POPULUS TRICHOCARPA, PINUS PONDEROSA, LARIX OCCIDENTALIS IN  
SURROUNDING FOREST.

Land owner/manager:

FLATHEAD NATIONAL FOREST, SWAN LAKE RANGER DISTRICT

Comments:

SIGHT RECORD, NO VOUCHER SPECIMEN COLLECTED.

Information source:

SCHASSBERGER, L. A. 1990. MONITORING AND FIELD SURVEYS OF 10-13 AND  
17-19 JULY (HOWELLIA AQUATILIS).

Element Occurrence Record  
Howellia aquatilis

39

Occurrence number: 023

Global rank: G2      Forest Service status: SENSITIVE LIST  
State rank: S2      Federal Status: C1

Survey site name: CONDON CREEK  
EO rank: C  
EO rank comments: MEDIUM-SIZED POPULATION; AREA BEING  
LOGGED.

County: MISSOULA

USGS quadrangle: CONDON

Township-range: 021N016W    Section: 18      Precision: S  
Township-range comments: NW4SE4SW4

Survey date: 1987-07-02      Elevation: 3740  
First observation: 1987      Slope/aspect: LEVEL  
Last observation: 1990-07-10      Size (acres): 1

Location:

SWAN VALLEY, 3.2 AIR MILES NORTH OF CONDON, 2.10 AIR MILES EAST OF ST.  
HWY 83, 0.35 AIR MILES SOUTH OF CONDON CREEK.

Element occurrence data:

1990: 20 PLANTS; 1989: 400-500 PLANTS; 1987: 3 PLANTS (1987); SEVERAL  
HUNDRED PLANTS OBSERVED IN 1986 BY P. LESICA; NEARBY FORESTS RECENTLY  
LOGGED.

General site description:

IN SHALLOW WATER OF A GLACIAL DEPRESSION; WITH SIUM SUAVE, CAREX  
VESICARIA; POPULUS TRICHOCARPA, PINUS PONDEROSA, LARIX OCCIDENTALIS IN  
SURROUNDING FOREST.

Land owner/manager:

FLATHEAD NATIONAL FOREST, SWAN LAKE RANGER DISTRICT

Comments:

SIGHT RECORD, NO VOUCHER SPECIMEN COLLECTED.

Information source:

SCHASSBERGER, L. A. 1990. MONITORING AND FIELD SURVEYS OF 10-13 AND  
17-19 JULY (HOWELLIA AQUATILIS).

Element Occurrence Record  
Howellia aquatilis

40

Occurrence number: 025

Global rank: G2      Forest Service status: SENSITIVE LIST  
State rank: S2      Federal Status: C1

Survey site name: CONDON CREEK  
EO rank: D  
EO rank comments: SMALL POPULATION; POND MARGIN IMPACTED  
BY LOGGING.

County: MISSOULA

USGS quadrangle: CONDON

Township-range: 021N016W    Section: 18      Precision: S  
Township-range comments: S2SE4SW4

Survey date: 1987-07-02      Elevation: 3750  
First observation: 1987      Slope/aspect: LEVEL  
Last observation: 1990-07-11      Size (acres): 2

Location:

SWAN VALLEY, 3.08 AIR MILES NORTH OF CONDON, 2.18 AIR MILES EAST OF  
ST. HWY 83, 0.45 AIR MILES SOUTH OF CONDON CREEK.

Element occurrence data:

1990: 0 PLANTS (CAREX AND NUPHAR VERY EXTENSIVE); 1989: 100-125  
PLANTS; 1987: EST. 25 PLANTS; POND MARGINS RECENTLY DISTURBED BY  
LOGGING.

General site description:

IN SHALLOW WATER OF A GLACIAL DEPRESSION; WITH SIUM SUAVE, CAREX  
VESICARIA; POPULUS TRICHOCARPA, PINUS PONDEROSA, LARIX OCCIDENTALIS IN  
SURROUNDING FOREST.

Land owner/manager:

FLATHEAD NATIONAL FOREST, SWAN LAKE RANGER DISTRICT

Comments:

SIGHT RECORD, NO VOUCHER SPECIMEN COLLECTED.

Information source:

SCHASSBERGER, L. A. 1990. MONITORING AND FIELD SURVEYS OF 10-13 AND  
17-19 JULY (HOWELLIA AQUATILIS).

Element Occurrence Record  
Howellia aquatilis

41

Occurrence number: 026

Global rank: G2      Forest Service status: SENSITIVE LIST  
State rank: S2      Federal Status: C1

Survey site name: CONDON CREEK  
EO rank: C  
EO rank comments: MEDIUM-SIZED POPULATION; AREA BEING  
LOGGED.

County: MISSOULA

USGS quadrangle: CONDON

Township-range: 021N016W    Section: 18      Precision: S  
Township-range comments: SE4NW4SW4

Survey date: 1987-07-02      Elevation: 3710  
First observation: 1987      Slope/aspect: LEVEL  
Last observation: 1990-07-12      Size (acres): 1

Location:

SWAN VALLEY, 3.29 AIR MILES NORTH OF CONDON, 1.97 AIR MILES EAST OF  
ST. HWY 83, 0.28 AIR MILES SOUTH OF CONDON CREEK.

Element occurrence data:

1990: 1000-2000 (VERY DENSE WITH MANY EMERGENT FLOWERING STEMS, ONLY  
MISSING FROM SHALLOW EDGES OF NORTHERN END OF POND); 1989: 500-1000  
PLANTS; 1987: EST. 200-300 PLANTS; NEARBY FORESTS RECENTLY LOGGED.

General site description:

IN SHALLOW WATER OF A GLACIAL DEPRESSION; WITH SIUM SUAVE, CAREX  
VESICARIA; POPULUS TRICHOCARPA, PINUS PONDEROSA, LARIX OCCIDENTALIS IN  
SURROUNDING FOREST.

Land owner/manager:

FLATHEAD NATIONAL FOREST, SWAN LAKE RANGER DISTRICT

Comments:

SIGHT RECORD, NO VOUCHER SPECIMEN COLLECTED.

Information source:

SCHASSBERGER, L. A. 1990. MONITORING AND FIELD SURVEYS OF 10-13 AND  
17-19 JULY (HOWELLIA AQUATILIS).

Element Occurrence Record  
Howellia aquatilis

42

Occurrence number: 027

Global rank: G2      Forest Service status: SENSITIVE LIST  
State rank: S2      Federal Status: C1

Survey site name: CONDON CREEK  
EO rank: D  
EO rank comments: MEDIUM-SIZED POPULATION; POND MARGIN  
IMPACTED BY LOGGING.

County: MISSOULA

USGS quadrangle: CONDON

Township-range: 021N016W    Section: 18      Precision: S  
Township-range comments: NW4SW4SW4

Survey date: 1987-07-02      Elevation: 3690  
First observation: 1987      Slope/aspect: LEVEL  
Last observation: 1990-07-17      Size (acres): 2

Location:

SWAN VALLEY, 3.18 AIR MILES NORTH OF CONDON, 1.84 AIR MILES EAST OF  
ST. HWY 83, 0.40 AIR MILES SOUTH OF CONDON CREEK.

Element occurrence data:

1990: 200+ PLANTS; 1989: 300-400 PLANTS; 1987: EST. 300 PLANTS; SOUTH  
MARGIN OF POND RECENTLY DISTURBED BY LOGGING.

General site description:

IN SHALLOW WATER OF A GLACIAL DEPRESSION; WITH SIUM SUAVE, CAREX  
VESICARIA; POPULUS TRICHOCARPA, PINUS PONDEROSA, LARIX OCCIDENTALIS IN  
SURROUNDING FOREST.

Land owner/manager:

FLATHEAD NATIONAL FOREST, SWAN LAKE RANGER DISTRICT

Comments:

SIGHT RECORD, NO VOUCHER SPECIMEN COLLECTED. pH=7.66.

Information source:

SCHASSBERGER, L. A. 1990. MONITORING AND FIELD SURVEYS OF 10-13 AND  
17-19 JULY (HOWELLIA AQUATILIS).

Element Occurrence Record  
Howellia aquatilis

43

Occurrence number: 029

Global rank: G2      Forest Service status: SENSITIVE LIST  
State rank: S2      Federal Status: C1

Survey site name: CONDON CREEK  
EO rank: D  
EO rank comments: MEDIUM-SIZED POPULATION; POND MARGINS  
IMPACTED BY LOGGING.

County: MISSOULA

USGS quadrangle: CONDON

Township-range: 021N016W    Section: 19      Precision: S  
Township-range comments: NW4NW4NW4

Survey date: 1987-07-02      Elevation: 3690  
First observation: 1987      Slope/aspect: LEVEL  
Last observation: 1990-07-10      Size (acres): 2

Location:

SWAN VALLEY, 2.97 AIR MILES NORTH OF CONDON, 1.88 AIR MILES EAST OF  
ST. HWY 83, 0.59 AIR MILES SOUTH OF CONDON CREEK.

Element occurrence data:

1990: 100-200 PLANTS (ONLY IN VERY SHALLOW EDGE WATERS); 1989:  
500-1000 PLANTS; 1987: EST. 200-300 PLANTS; POND MARGINS RECENTLY  
DISTURBED BY LOGGING.

General site description:

IN SHALLOW WATER OF A GLACIAL DEPRESSION; WITH SIUM SUAVE, CAREX  
VESICARIA; POPULUS TRICHOCARPA, PINUS PONDEROSA, LARIX OCCIDENTALIS IN  
SURROUNDING FOREST.

Land owner/manager:

BURLINGTON NORTHERN LAND

Comments:

SIGHT RECORD, NO VOUCHER SPECIMEN COLLECTED.

Information source:

SCHASSBERGER, L. A. 1990. MONITORING AND FIELD SURVEYS OF 10-13 AND  
17-19 JULY (HOWELLIA AQUATILIS).

Element Occurrence Record  
Howellia aquatilis

44

Occurrence number: 030

Global rank: G2      Forest Service status: SENSITIVE LIST  
State rank: S2      Federal Status: C1

Survey site name: CONDON CREEK  
EO rank: D  
EO rank comments: LARGE POPULATION; POND MARGINS IMPACTED  
BY LOGGING.

County: MISSOULA

USGS quadrangle: CONDON

Township-range: 021N016W    Section: 19      Precision: S  
Township-range comments: NE4NE4NW4

Survey date: 1987-07-02      Elevation: 3740  
First observation: 1987      Slope/aspect: LEVEL  
Last observation: 1990-07-12      Size (acres): 1

Location:

SWAN VALLEY, 2.99 AIR MILES NORTH OF CONDON, 2.19 AIR MILES EAST OF  
ST. HWY 83, 0.55 AIR MILES SOUTH OF CONDON CREEK.

Element occurrence data:

1990: 0 PLANTS; 1989 AND 1987: EST. 1000 PLANTS; POND MARGINS RECENTLY  
DISTURBED BY LOGGING.

General site description:

IN SHALLOW WATER OF A GLACIAL DEPRESSION; WITH SIUM SUAVE, CAREX  
VESICARIA; POPULUS TRICHOCARPA, PINUS PONDEROSA, LARIX OCCIDENTALIS IN  
SURROUNDING FOREST.

Land owner/manager:

BURLINGTON NORTHERN LAND

Comments:

SIGHT RECORD, NO VOUCHER SPECIMEN COLLECTED.

Information source:

SCHASSBERGER, L. A. 1990. MONITORING AND FIELD SURVEYS OF 10-13 AND  
17-19 JULY (HOWELLIA AQUATILIS).



Element Occurrence Record  
Howellia aquatilis

45

Occurrence number: 032

Global rank: G2      Forest Service status: SENSITIVE LIST  
State rank: S2      Federal Status: C1

Survey site name: LINDBERGH LAKE  
EO rank: B  
EO rank comments: MEDIUM-SIZED POPULATION; HABITAT  
RELATIVELY UNDISTURBED.

County: MISSOULA

USGS quadrangle: CYGNET LAKE

Township-range: 019N016W    Section: 07      Precision: S  
Township-range comments: SE4SW4NW4

Survey date: 1983-07-24      Elevation: 4165  
First observation: 1983      Slope/aspect: LEVEL  
Last observation: 1990-07-10      Size (acres): 2

Location:

SWAN VALLEY, 0.16 AIR MILES SOUTH OF LINDBERGH LAKE RD., CA. 1.75 AIR  
MILES WEST OF ST. HWY 83.

Element occurrence data:

1990: 3-10 PLANTS (PLANTS INTERTWINED, DIFFICULT TO ESTIMATE; FEW Sium  
suave PRESENT); 1989: 750-1000 PLANTS; 1983: EST. 101-1000 PLANTS.

General site description:

GLACIAL POTHOLE, IN ONE TO TWO FEET OF WATER; WITH EQUISETUM  
FLUVIATILE, SIUM SUAVE, TYPHA, CAREX ROSTRATA; POPULUS TRICHOCARPA, P.  
TREMULOIDES AROUND POND.

Land owner/manager:

PRIVATELY OWNED LAND (INDIVIDUAL OR CORPORATE)

Comments:

Information source:

SCHASSBERGER, L. A. 1990. MONITORING AND FIELD SURVEYS OF 10-13 AND  
17-19 JULY (HOWELLIA AQUATILIS).

Element Occurrence Record  
Howellia aquatilis

46

Occurrence number: 035

Global rank: G2      Forest Service status: SENSITIVE LIST  
State rank: S2      Federal Status: C1

Survey site name: LINDBERGH LAKE  
EO rank: B  
EO rank comments: MEDIUM-SIZED POPULATION; HABITAT  
RELATIVELY UNDISTURBED.

County: MISSOULA

USGS quadrangle: CYGNET LAKE

Township-range: 019N016W    Section: 07      Precision: S  
Township-range comments: E2NE4SW4

Survey date: 1983-07-24      Elevation: 4150  
First observation: 1983      Slope/aspect: LEVEL  
Last observation: 1990-07-10      Size (acres): 2

Location:

SWAN VALLEY, 0.38 AIR MILES SOUTH OF LINDBERGH LAKE RD., CA. 1.5 AIR  
MILES WEST OF ST. HWY 83.

Element occurrence data:

1990: 0 PLANTS (NO SIUM SUAVE PRESENT, WATER DEEP YELLOW RED, OILY  
SCUM AT SURFACE (POSSIBLY DUE TO HIGH LEAF CONTENT)); 1989: 500-750  
PLANTS; 1983: EST. 51-1000 PLANTS.

General site description:

GLACIAL POTHOLE, IN 0.5-1.5 FEET OF WATER; WITH SIUM SUAVE, CAREX  
ROSTRATA.

Land owner/manager:

PRIVATELY OWNED LAND (INDIVIDUAL OR CORPORATE)

Comments:

Information source:

SCHASSBERGER, L. A. 1990. MONITORING AND FIELD SURVEYS OF 10-13 AND  
17-19 JULY (HOWELLIA AQUATILIS).

Element Occurrence Record  
Howellia aquatilis

47

Occurrence number: 044

Global rank: G2      Forest Service status: SENSITIVE LIST  
State rank: S2      Federal Status: C1

Survey site name: LINDBERGH LAKE  
EO rank: C  
EO rank comments: LARGE POPULATION; ADJACENT TO A GRAVEL  
ROAD.

County: MISSOULA

USGS quadrangle: CYGNET LAKE

Township-range: 019N017W    Section: 12      Precision: S  
Township-range comments: S2SE4NE4, N2NE4SE4

Survey date: 1987-07-29	Elevation: 4215
First observation: 1987	Slope/aspect: LEVEL
Last observation: 1990-07-10	Size (acres): 1

Location:

SWAN VALLEY, SOUTHEAST OF LINDBERGH LAKE RD., 2.0 AIR MILES WEST OF  
ST. HWY 83.

Element occurrence data:

1990: 0 PLANTS (POND HAD OILY SLICK ON SURFACE, DEEP RUST COLORED  
WATER, VERY LITTLE SIUM SUAVE PRESENT); 1989: 90-120 PLANTS; 1987:  
EST. 275-400 PLANTS; POND IS ALONGSIDE A HEAVILY USED GRAVEL ROAD, AND  
IS UNDER A POWER LINE.

General site description:

GLACIAL POTHOLE DEPRESSION; WITH CAREX VESICARIA, SIUM SUAVE,  
RANUNCULUS AQUATILIS; POPULUS TRICHOCARPA, P. TREMULOIDES PINUS  
CONTORTA, LARIX OCCIDENTALIS AROUND POND.

Land owner/manager:

FLATHEAD NATIONAL FOREST, SWAN LAKE RANGER DISTRICT

Comments:

Information source:

SCHASSBERGER, L. A. 1990. MONITORING AND FIELD SURVEYS OF 10-13 AND  
17-19 JULY (HOWELLIA AQUATILIS).

Element Occurrence Record  
Howellia aquatilis

48

Occurrence number: 045

Global rank: G2      Forest Service status: SENSITIVE LIST  
State rank: S2      Federal Status: C1

Survey site name: LINDBERGH LAKE  
EO rank: C  
EO rank comments: FAIRLY SMALL POPULATION, NEARBY AREAS  
LOGGED.

County: MISSOULA

USGS quadrangle: CYGNET LAKE

Township-range: 019N016W    Section: 18      Precision: S  
Township-range comments: SE4SW4SE4

Survey date:	1987-07-10	Elevation:	4250
First observation:	1987	Slope/aspect:	LEVEL
Last observation:	1990-07-09	Size (acres):	2

Location:

SWAN VALLEY, 1.83 AIR MILES ESE OF NORTH END OF LINDBERGH LAKE, 1.08  
AIR MILES SOUTH OF SWAN RIVER, CA. 2.0 AIR MILES WEST OF ST. HWY 83.

Element occurrence data:

1990: 10 PLANTS (HEAVY ALGAL BLOOMS, WATER RUST COLORED, WATER  
APPEARED DEEPER); 1989: 300-400 PLANTS; 1987: EST. 300

General site description:

GLACIAL POTHOLE POND, SURROUNDED BY PINUS CONTORTA FOREST, POPULUS  
TREMULOIDES NEAR MARGIN; WITH CAREX VESICARIA, EQUISETUM FLUVIATILE,  
POTAMOGETON GRAMINEUS, SIUM SUAVE.

Land owner/manager:

FLATHEAD NATIONAL FOREST, SWAN LAKE RANGER DISTRICT

Comments:

VOUCHER - SHELLY, J.S. (1364) AND L. CAMPBELL, 1987, MONTU.

Information source:

SCHASSBERGER, L. A. 1990. MONITORING AND FIELD SURVEYS OF 10-13 AND  
17-19 JULY (HOWELLIA AQUATILIS).

Element Occurrence Record  
Howellia aquatilis

49

Occurrence number: 046

Global rank: G2      Forest Service status: SENSITIVE LIST  
State rank: S2      Federal Status: C1

Survey site name: LINDBERGH LAKE  
EO rank: D  
EO rank comments: SMALL POPULATION; SURROUNDING HABITAT  
DISTURBED BY LOGGING.

County: MISSOULA

USGS quadrangle: CYGNET LAKE

Township-range: 019N016W    Section: 18      Precision: S  
Township-range comments: SW4NW4NW4

Survey date: 1987-07-10      Elevation: 4230  
First observation: 1987      Slope/aspect: LEVEL  
Last observation: 1990-07-09      Size (acres): 1

Location:

SWAN VALLEY, 0.58 AIR MILES SOUTH OF SWAN RIVER, 2.13 AIR MILES WEST  
OF ST. HWY 83.

Element occurrence data:

1990: 3 PLANTS (NEAR AREA OF SIUM SUAVE); 1989: 30-50 PLANTS; 1987:  
EST. 50 PLANTS; ADJACENT AREAS DISTURBED BY CLEARCUT LOGGING.

General site description:

GLACIAL POTHOLE POND; WITH SIUM SUAVE, CAREX VESICARIA, TYPHA,  
RANUNCULUS GMELINII, POTAMOGETON GRAMINEUS.

Land owner/manager:

FLATHEAD NATIONAL FOREST, SWAN LAKE RANGER DISTRICT

Comments:

VOUCHER - SHELLY, J.S. (1368) AND L. CAMPBELL, 1987, MONTU.

Information source:

SCHASSBERGER, L. A. 1990. MONITORING AND FIELD SURVEYS OF 10-13 AND  
17-19 JULY (HOWELLIA AQUATILIS).

Element Occurrence Record  
Howellia aquatilis

50

Occurrence number: 047

Global rank: G2      Forest Service status: SENSITIVE LIST  
State rank: S2      Federal Status: C1

Survey site name: LINDBERGH LAKE  
EO rank: C  
EO rank comments: MED.-SIZED POPULATION; SURROUNDING AREA  
DISTURBED BY LOGGING

County: MISSOULA

USGS quadrangle: CYGNET LAKE

Township-range: 019N016W    Section: 18      Precision: S  
Township-range comments: SW4NE4NW4

Survey date: 1987-07-10      Elevation: 4215  
First observation: 1987      Slope/aspect: LEVEL  
Last observation: 1990-07-09      Size (acres): 1

Location:

SWAN VALLEY, 0.5 AIR MILES SOUTH OF SWAN RIVER, 1.95 AIR MILES WEST OF  
ST. HWY 83.

Element occurrence data:

1990: 150 PLANTS; 1989 200-300 PLANTS; 1987: EST. 200 PLANTS; POND  
LOCATED ON EDGE OF A CLEARCUT.

General site description:

GLACIAL DEPRESSION; WITH SIUM SUAVE, CAREX VESICARIA, TYPHA LATIFOLIA,  
NUPHAR VARIEGATUM, ELEOCHARIS PALUSTRIS, SPARGANIUM MINIMUM; ALNUS ON  
EDGES, NO POPULUS.

Land owner/manager:

FLATHEAD NATIONAL FOREST, SWAN LAKE RANGER DISTRICT

Comments:

VOUCHER - SHELLY, J.S. (1365) AND L. CAMPBELL, 1987, MONTU.

Information source:

SCHASSBERGER, L. A. 1990. MONITORING AND FIELD SURVEYS OF 10-13 AND  
17-19 JULY (HOWELLIA AQUATILIS).

Element Occurrence Record  
Howellia aquatilis

51

Occurrence number: 048

Global rank: G2      Forest Service status: SENSITIVE LIST  
State rank: S2      Federal Status: C1

Survey site name: LINDBERGH LAKE  
EO rank: C  
EO rank comments: MED.-SIZED POPULATION; SURROUNDING AREA  
DISTURBED BY LOGGING

County: MISSOULA

USGS quadrangle: CYGNET LAKE

Township-range: 019N016W    Section: 18      Precision: S  
Township-range comments: SW4NE4NW4

Survey date: 1987-07-10      Elevation: 4215  
First observation: 1987      Slope/aspect: LEVEL  
Last observation: 1990-07-09      Size (acres): 1

Location:

SWAN VALLEY, 0.5 AIR MILES SOUTH OF SWAN RIVER, 1.89 AIR MILES WEST OF  
ST. HWY 83.

Element occurrence data:

1990: 0 PLANTS OBSERVED (MANY DEAD SEDGE PLANTS SOUTH END OF POND,  
DEAD TYPHA IN NORTH END, WATER APPEARED DEEPER THAN IN 1989); 1989:  
CA: 200 PLANTS; 1987: EST. 250 PLANTS; ADJACENT AREAS DISTURBED BY  
CLEARCUT LOGGING.

General site description:

GLACIAL POTHOLE POND; WITH CAREX VESICARIA, SIUM SUAVE, EQUISETUM  
FLUVIATILE, TYPHA LATIFOLIA.

Land owner/manager:

FLATHEAD NATIONAL FOREST, SWAN LAKE RANGER DISTRICT

Comments:

VOUCHER - SHELLY, J.S. (1366) AND L. CAMPBELL, 1987, MONTU.

Information source:

SCHASSBERGER, L. A. 1990. MONITORING AND FIELD SURVEYS OF 10-13 AND  
17-19 JULY (HOWELLIA AQUATILIS).

Element Occurrence Record  
Howellia aquatilis

52

Occurrence number: 049

Global rank: G2      Forest Service status: SENSITIVE LIST  
State rank: S2      Federal Status: C1

Survey site name: LINDBERGH LAKE  
EO rank: C  
EO rank comments: LARGE POPULATION; ADJACENT TO NEW  
LOGGING ROAD.

County: MISSOULA

USGS quadrangle: CYGNET LAKE

Township-range: 019N016W    Section: 07      Precision: S  
Township-range comments: SW4SW4SE4

Survey date: 1987-07-10      Elevation: 4150  
First observation: 1987      Slope/aspect: LEVEL  
Last observation: 1990-07-09      Size (acres): 1

Location:

SWAN VALLEY, 0.16 AIR MILES SOUTH OF SWAN RIVER, 1.60 AIR MILES WEST  
OF ST. HWY 83.

Element occurrence data:

1990: 200-300 PLANTS (HIGH COVER OF LEMNA MINOR IN SOME AREAS); 1989:  
2000+ PLANTS; 1987: EST. 1500-2000 PLANTS; POND IS ON NORTH SIDE OF A  
NEWLY CONSTRUCTED LOGGING ROAD, JUST NORTH OF USFS BOUNDARY.

General site description:

GLACIAL POTHOLE POND; WITH CAREX ROSTRATA, C. VESICARIA, RANUNCULUS  
GMELINII, R. AQUATILIS, ALOPECURUS AEQUALIS; POPULUS SPP., ALNUS  
INCANA, SALIX SPP. AROUND EDGE.

Land owner/manager:

PRIVATELY OWNED LAND (INDIVIDUAL OR CORPORATE)

Comments:

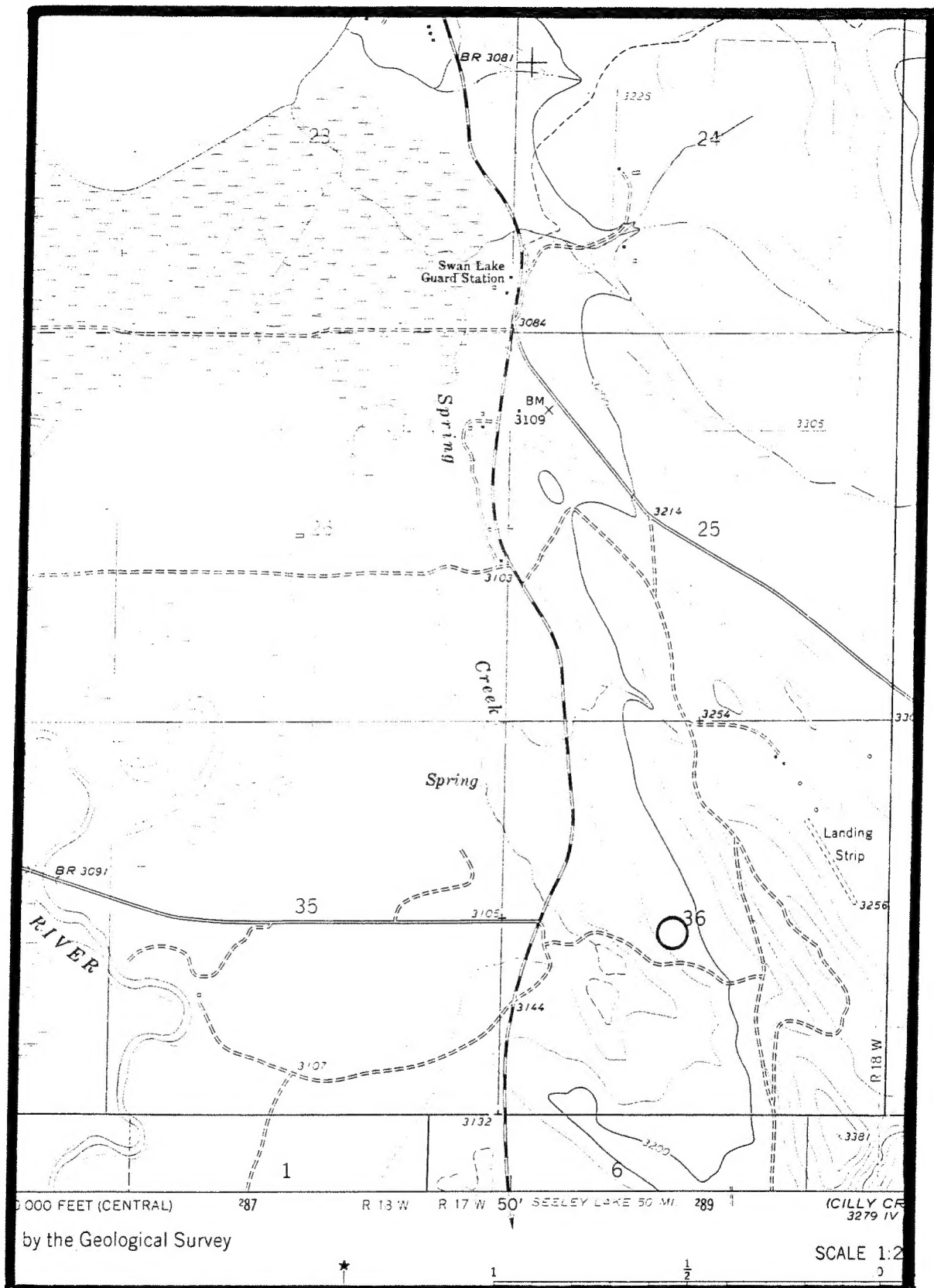
VOUCHER - SHELLY, J.S. (1369) AND L. CAMPBELL, 1987, MONTU. pH=7.29.

Information source:

SCHASSBERGER, L. A. 1990. MONITORING AND FIELD SURVEYS OF 10-13 AND  
17-19 JULY (HOWELLIA AQUATILIS).

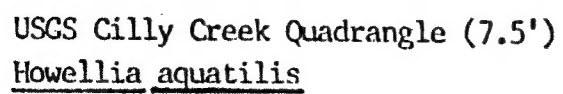


**IX. MAPS OF PONDS SURVEYED WITHOUT SUCCESS**



USGS Swan Lake Quadrangle (7.5')  
Howellia aquatilis

○ = pond searched,  
H. aquatilis not  
 present



● = element occurrences  
○ = ponds searched,  
H. aquatilis not  
present

## X. LITERATURE CITED

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